REPORT RESUMES

ED 003 232 56

A COMPARISON BETWEEN DIFFERENT STIMULI COMBINED WITH TWO METHODS FOR PROVIDING KNOWLEDGE OF RESULTS IN MUSIC INSTRUCTION.

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REPORT NUMBER NDEA-VIIA-1088 PUB DATE 65
REPORT NUMBER RF-1677
GRANT OEG-7-45-0430-214
EDRS PRICE MF-$0.36 HC-$9.24 231P.

DESCRIPTORS- *MUSIC TECHNIQUES, *PROGRAMED INSTRUCTION, *EXPERIMENTAL TEACHING, COMPARATIVE ANALYSIS, AUDIOVISUAL INSTRUCTION, COLLEGE STUDENTS, *TAPE RECORDINGS, *MUSIC EDUCATION, *LEARNING, COLUMBUS, OHIO

FOUR EXPERIMENTS WERE CONDUCTED TO STUDY THE EFFECTIVENESS OF DIFFERENT METHODS FOR TEACHING MUSIC. VARIOUS MUSIC STIMULUS MATERIALS WERE COMBINED, AND INSTRUCTION WAS OFFERED IN RHYTHM, INTERVALS, TONE GROUPS, AND MELODIES. THESE WERE PRESENTED ON MAGNETIC TAPE TO UNIVERSITY STUDENTS IN A UNIFORM AND CONSISTENT MANNER. ANALYSIS WAS MADE OF A NUMBER OF VARIABLES. IT WAS DETERMINED THAT ONE METHOD WAS EQUALLY AS EFFECTIVE AS ANOTHER FOR LEARNING. THERE WERE ALSO INDICATIONS THAT BACKGROUND FACTORS AFFECT STUDENTS' LEARNING. RECOMMENDATIONS SUGGESTED FURTHER RESEARCH IN THIS FIELD TO INVESTIGATE INDIVIDUAL DIFFERENCES TO DETERMINE THE MOST SUITABLE INSTRUCTION METHOD FOR LEARNING MUSIC. (RS)

ED003232

1088

RF Project 1677
Final Report
October, 1965

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A Comparison between Different Stimuli Combined with Two Methods for Providing Knowledge of Results in Music Instruction

Title VII Project Number 1088
National Defense Education Act of 1958
Grant Number 7-45-0430-214

Charles L. Spohn, Principal Investigator

The Research Reported Herein Was
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The Ohio State University
RESEARCH FOUNDATION
Columbus, Ohio 43212

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PREFACE

This study was undertaken as an extension of earlier research and was to investigate certain phases of the problem of learning music. More specifically, however, the research was directed toward the perception of organized sounds and symbols.

Since music learning is most often considered a specialized interest area, every effort has been made to maximize the applicability of these data to other areas of learning which have similar problems. The hope is expressed that these findings will provide an additional understanding of the general problem of aural and visual perception.

This work has been made possible by the interest and cooperation of many individuals. Graduate students, who were Research Assistants, Ronald Boswell, Nancy Fowler, James Lindholm, David Livingston, David Noe, Robert Reynolds, and Joseph Thomas, were most helpful by assisting in the preparation of materials and the gathering of data. The classroom teachers, Burdette Green, coordinator, Paul Brink, Charles Vedder, Theron McClure, and Caroline Henning were most helpful and cooperative. Dr. D. Ransom Whitney and Dr. William Poland provided invaluable assistance in the statistical analysis of the data. Professor Gertrude Kuehefuhs, chairman of the music theory area, has been most understanding and helpful. Motivation and interest provided by Dr. Ross Mooney, Professor, Bureau Of Education Research and Service, Dr. Egon Guba, Director, Bureau of Educational Research and Service, and Dr. David Clark, Associate Dean, College of Education, were encouraging in the early stages of the study. The secretarial skill of Miss Marilyn K. Aldridge contributed greatly to the overall success of the project.

Columbus, Ohio
October 1965

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PART I

INTRODUCTION, RELATED RESEARCH, AND PROBLEM

Introduction

There appears to be an infinite number of problems associated with learning. Each area of learning has its own characteristic problems, needs, and peculiarities. Similarities, however, between the problems and needs of various areas of learning probably do exist. There are sociological needs which complicate learning problems. There are more students learning knowledge and skills. There are new scientific achievements. There is more information to be learned. The need to bring about efficiency in learning is of great importance.

Students are subjected to instruction and methodology that is open to question. Instruction is administered a particular way because it has always been done this way. It is a well established fact that even though all students in a school or a classroom have the opportunity to learn, there is a wide difference in the amount of learning a group of students accomplishes. The student is faced with the problem of learning a quantity of information as well as a large number of skills in a prescribed way. The teacher is faced with the problem of presenting information for student learning in a manner which will provide all students with the opportunity to learn a quantity of knowledge and skills. One of the questions which becomes exceedingly important is: "Does everyone learn the same knowledge in the same manner?" A second question is: "What do people learn from a method of instruction?"

There are a variety of ways in which information and materials may be presented. Teachers prescribe a particular method for presenting information to students. The development of alternative techniques is a problem faced by teachers in all areas of learning. In formal classes, students normally get the opportunity to learn only by one method. The students probably are limited because of their exposure to only one method.

Teachers are increasingly aware of and concerned about individual differences in learning situations. Little, however, is accomplished in applying this concern to different methods of instruction. It is here implied that the need in the current route in education is the development of multiple methods which will be effective for teaching the same information to different students. This implication assumes that different methods of instruction can be developed and that these methods will have different effectiveness for different students.

Students enrolled in institutions of higher learning are receiving instruction in many areas which prepares them to be teachers in the public schools. Specifically, many students are enrolled in teacher training institutions with the purpose of becoming public school music teachers. As a part of their instruction these students are expected to acquire knowledge and skills which are related to the aural and visual perception of music. These students must develop skills which will enable them to perceive a specific music stimulus and make an appropriate response. It is necessary that this information and ability become part of the knowledge which will be imparted in future years to students in the public schools.

The reality must be faced, that optimum learning in music has not been achieved for those who are specializing in the field of music teachers. Basic conflicts in music instruction are apparent. Such a condition has brought about three problems. First, it has inhibited the search for information about how people develop skills in music. Second, there has been a lack of interest in developing new technology for people to learn the aural and visual skills needed in music. Third, with more people to teach it is difficult to keep old methodology effective for increasing numbers of people.

All higher education music curricula are based on the assumption that the technical knowledge of music is vital to the understanding of music and to the attainment of the skills necessary to perform, to write, and to teach music. The syllabi and methods used in these classes are often based on practices which have not changed for years. The presentation of materials is based on the same method of teaching as the teacher was taught. The result has been that the best students meet the requirements with apparent ease and seldom do more. The students with weak pre-college backgrounds struggle with little or no success, and fail. The results of the teaching-learning effort are frustrating to both the teacher and the student. Traditional music instruction in teacher education has tended to reinfect society with its own ills. It is not unusual to hear higher education music teachers express disappointment in the achievementof their students. Often college students are also disappointed in how little they have learned. The blame is placed by the student on the teacher and by the teacher on the student. It is perhaps true that students learn from a variety of presentations when and if they have the opportunity; students probably do not learn from only one kind of presentation, method, or technique.

As a result of their varied background, students enter the Fundamentals of Music instruction (which are directed towards the learning of skills related to the aural and visual perception of music) with different levels of ability to perceive music. Individual differences in learning are evident from the outset of the instructional program. Students appear to respond differently to the same materials and methods. The wide range of individual differences has made the development of teaching materials and techniques difficult to evaluate. Classroom procedures and teaching materials used to enable students to learn aural and visual music skills are most often based only on assumptions that are not objectively tested and evaluated. If procedures and materials are evaluated, it is seldom more than on a practical classroom basis. It is difficult, therefore, to make generalized judgments about music learning.

Related Research

Educational and psychological research has investigated various reinforcement theories and knowledge of results in learning (Keller 1954). Connette (1941) investigated the learning of pitch discrimination when students practiced and were given knowledge of results about the accuracy of their judgment. The experimenter presented pitch stimuli to the individual subjects by use of tuning forks. The subjects made judgments and were informed immediately by an assistant whether the judgment was high, low, or correct. Their pitch discrimination was greatly improved. Keller (1943) taught Morse Code perception when he (1) presented a signal to the student, (2) gave time for a written response, and (3) identified the signal for the subject. Spohn (1962a) used a modification of Keller's method in the tape-recorded self-instructional presentation of intervals. Spohn's method for interval learning was more effective than traditional classroom instruction. In the development of a disc cutting operation in industry Lindahl (1945) produced evidence that the individual study of graphic movement analysis forms made it possible for each operator of a disc cutting machine to discover the correct stimulus which would lead to an improved product. Lindahl's statement is that, "The person doing the training must constantly give due considerations to these individual differences in order to get the entire group to the stage of perfection he desires."

A report by Turner and Fattu (1960) suggested that it is important for the teacher, in helping the student solve his problems, to utilize the greatest possible number of alternative techniques, and to be able to apply these methods in new situations. In substance Turner and Fattu supported Lindahl's (1945) statement concerning the teacher's responsibility to meet individual differences.

Spohn's self-presentation methods employed in research at The Ohio State University School of Music incorporated a modification of the immediate knowledge of results concept used by Keller. This method gave immediate knowledge of results from which the student was given the correct answer recorded on tape.

The work of Connette and Lindahl suggested that effective knowledge of results involved more than the mere identification of the answer. Spohn and Poland (1964) indicated that immediate knowledge of results as a pre-recorded answer was not as effective for some students as it was for others. There was a need for research which made systematic comparisons to study the effect of individuals' perception when different methods for providing immediate knowledge of results were used.

Research which investigated the differential effects of aural or visual presentation of basic music material and written or voice responses provided a firm foundation on which other variables in the music learning process can be investigated (Spohn, Poland, 1964). This research utilized new methodology and technology which were employed in a controlled laboratory situation. In this research, where there were significant effects due to experimental treatment, student response made a greater effect in learning than did the manner of stimulus presentation. These patterns varied with the material learned; for example, rhythm, interval, and tone groups. The background factors which included various aspects of specific music training, as well as general music education were shown to have some influences upon the student's learning. The data from this research supported the position that there was not a single best treatment unless the particular objective was stated. Patterns of difference from the use of the four experimental treatments investigating presentation and response differed when compared with learning intervals, rhythm, and tone groups. For each of these materials, however, if a specific objective was stated, a best treatment could be specified with some degree of confidence. The tasks the students were asked to do differed in difficulty both within and across content classification. For example, the task of rhythm learning for the students was easy; the task of interval learning for the students was of moderate difficulty; the task of tone group learning for the students was difficult. Stimulus mode-response mode interaction appeared to play a small part in the differences. Only in the interval and rhythm experimental treatment of visual stimulus-written response did interaction between response and stimulus appear as the only effect. The stimulus mode appeared to be the important effect only for intervals. The manner by which students made a response was important in both moderately and very difficult tasks.

The Problem

Data from the Spohn and Poland research indicated that all students in the self-presentation music learning program learned various tasks to a higher degree of proficiency than students using traditional procedures. It was observed from these data that there was the necessity to develop additional methods and materials to meet the individual needs of students in their learning of the elements of music.

Past research (Spohn, Poland 1964) indicated that learning the aural and visual skills of music perception were not based only on stimulus presentation or response mode. There were other variables to be considered. Of general interest was the alternative ways by which information can be given back to the student; that is alternative means of providing knowledge of results. Research has been done to indicate the importance of knowledge of results; however, little has been done to determine the importance of different methods of immediate knowledge of results, for instance, "Is learning the element of music better with aural or visual immediate knowledge of results?"

Rhythms, intervals, and tone groups as music stimuli were presented to students in various forms. Contrasting information existed relative to the effectiveness of several possible music stimuli presentations. Commonly used music instructional material was based upon the belief that a particular rhythmic presentation, interval presentation, or short melodic fragment presentation was the way in which students learned best.

In addition to the questions about specific music stimulus presentation, there was a need to ask more sophisticated questions about music learning. It was necessary to combine the elements and skills learned in the elements of music into higher order units which permit the investigation of three basic organizational patterns of material. These three patterns were (1) traditionally meaningful or contextual units, melodies from the literature; (2) large non-contextual units of music developed to present problems of progressing difficulty which might be found in actual music, drills on rhythm and pitch; (3) small units of music (tone groups) which were progressively expanded into larger spacial and temporal units, tone groups expanded to include more complex pitches and rhythms.

One question was "Can knowledge of results be provided in alternative ways and if so, will it make any difference to the learning of students?" A second question was "When students are presented rhythm, intervals, and tone groups in any one of the several possibilities, what do they learn?" Third, the important question which involved the psychological principles of meaningfulness and grouping, "Do people learn to perceive longer segments of music (1) by meaningful unit presentation, (2) by drills devised from rhythmic and tonal elements found in meaningful units, or (3) by progressing from smaller to larger units as suggested by visual perception research?"

The problem was to determine the best combination of stimulus perceptual material with aural or visual immediate knowledge of results when learning rhythm, intervals, tone groups and melodies. This report provides evidence on the questions based on research work with music students who were taught by means of self-instructional music materials.

Figure 1.

Experimental Design for this Study

Programed Self-Instructional Tape Recorded Elemental Materials of Music	Aural Knowledge of Results	Visual Knowledge of Results
Phase I (Freshmen, 1963-64) Single Tone Source Rhythmic Treatment* Ascending Interval Treatment Ascending Tone Group Treatment	Student Group 1	Student Group 4
Phase II (Sophomores, 1964-65) Contextual Music Phrase Treatment		
Phase I (Freshmen, 1963-64) Melodic Rhythmic Treatment* Descending Interval Treatment Descending Tone Group Treatment	Student Group 2	Student Group 5
Phase II (Sophomores, 1964-65) Non-Contextual Drill Music Phrase Treatment		
Phase I (Freshmen, 1963-64) Taps Rhythmic Treatment* Harmonic Interval Treatment Ascending and Descending Tone Group Treatment	Student Group 3	Student Group 6
Phase II (Sophomores, 1964-65) Small Unit Music Phrase Treatment		

*Alternative treatments are explained in the reporting of each experiment.

Summary

The research reported here was designed to compare the effectiveness of learning different music elements presented to students in different ways with either aural knowledge of results or visual knowledge of results. Figure 1 shows the two by three experimental design for the study. This design was used for each of the four experiments.

Special programs were written which offered instruction in four categories of music instruction: rhythms, intervals, tone groups, and music melodies. These programs were specially adapted for presentation on magnetic tape so that it could be used in The Ohio State University Music Audio-Visual Training Laboratory. The four experiments will be described in the order in which they occurred.

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PART II

PHASE I, EXPERIMENT NUMBER 1, RHYTHM

Introduction

An essential part of music learning is the ability to perceive rhythm accurately. Rhythm was defined as regular occurring units of time or pulses. Such a definition, however, did not take into consideration the many ways in which rhythm can be presented. The rhythm performed by a singer was different, perhaps, than the rhythm sounded by a clarinet or perhaps by some percussion instrument. One of the concerns in music instruction, therefore, would be, "Is rhythm played by one instrument the same as a rhythm played by another instrument?" If a teacher is to arbitrarily use taps to illustrate rhythmic examples, would this be the same instruction as rhythm played on a piano on a single tone or with a melody?

Rhythm as one element of music has been taught and investigated when presented as (1) taps, (2) units of time sounded with a single tone source, (3) as part of a melodic background. Skinner (1961) in a training program with young children employed a rhythm teaching machine with which students learned to reproduce rhythms by tapping a key. Petzold (1960b), in developing tests to evaluate rhythmic perception learned by elementary children, had students respond by singing on a fixed-tone-source. For testing purposes Poland (1960) used a melodic background (series of tones) to support the rhythm being presented. Spohn (1959 and 1962c) presented rhythm for training in perceptual learning, on a single-tone source; this research which investigated stimulus-response presentation was restricted to the presentation of rhythm on a single tone source.

There is a difficulty with taps or clicked rhythms since short sounds do not necessarily indicate rhythmic duration. The duration between attacks must be thought or produced in the conscious of the perceiver. Some teachers believe this manner of rhythmic stimulus is difficult for some persons to learn. An argument in support of this presentation, however, is that rhythm presented by taps is well articulated and can be regulated with great accuracy. Taps are readily distinguished and therefore might be more easily perceived.

Rhythm presented with a series of different tones (melody) is another way in which persons might be confronted with rhythmic stimuli. Rhythm presented in this manner, however, could very well be confused with the melodic element. The fact that there is an additional cue (tones) could be misleading to students. Students are taught rhythm at early ages by means of songs learned by rote. It is, therefore, possible that these students do not attend to the problem of rhythmic learning as well as they might if rhythm were isolated and was the only music element heard. Rhythm presented with a series of tones is possibly confused with the melodic element (Petzold 1960a). For some students tone cues may be a more effective aid in learning rhythm.

A single reiterated tone, however, might combine tone and taps into an effective method for learning rhythm. The use of a single tone source reiterated for rhythmic presentation is perhaps best characterized by the Morse code operator. Such a signaling device does indicate a flow of patterns which are rhythmic. A similar environment in music would be one of repeating different rhythmic patterns with a single note on the piano. The repetition of a rhythm pattern reiterated on a single tone source provides an attack at the beginning of the sound as well as duration.

Presentation method alone was not the only problem. Past research (Spohn, Poland 1964) had indicated that some students had difficulty in making use of the information given to them after they had made a response to a rhythmic stimulus. This investigator believed that the manner by which knowledge of results was given to the student could improve learning rhythms. This study compared two methods for presenting knowledge of results after students made a response to a rhythmic stimulus. First, the voiced correct answer for each item was pre-recorded on tape (aural knowledge of results). Second, lights similar to flashes used in signaling which show a rhythmic pattern visually were flashed with the same rhythmic pattern the student heard as a stimulus (visual knowledge of results).

Specifically, this study was to determine:

(1) whether one kind of rhythmic presentation (single tone source, melodic background, or taps) facilitated the learning of rhythm,

(2) whether one mode of rhythmic presentation was more useful overall than another,

(3) whether a particular method of aural or visual knowledge of results facilitated the learning of rhythmic taps, single tone source rhythm, or rhythms presented with a series of tones, and

(4) whether one method of providing knowledge of results was more useful than another in learning a particular rhythm presentation.

METHOD

Subjects

The freshman class at The School of Music at The Ohio State University Fall 1963 were the subjects for this experiment. There were diagnostic tests and music auditions which all students took in order to be admitted as music majors (Spohn, Poland 1964, p. 27). Ninety-five students of this

Table I

Summary of the Analysis of Variance of
Predicted First Quarter Freshman Fundamentals of Music Grades
for 300 Students in the 1961, 1962, 1963 Freshman Classes

	1961	1962	1963	F(2,297)
Number of Students	101	104	95	
Mean Predicted Grade	2.64	2.76	2.70	.66 N S

(With df 2,00, $F_{(.05)} = 2.99$)

freshman class completed the first experiment during the ten-week instructional period of the Fall quarter. Table I shows that this class was representative of the students who were admitted in past years as freshmen music majors at The Ohio State University.

Materials

The instructional materials used in this study were similar to those used and recorded in previous research (Spohn, Poland 1964, p. 16). One method from the previous study (aural presentation of rhythms sounded on a single tone source with written response) was chosen on the basis of its effectiveness in the instruction of students to learn rhythm. The materials were programed and recorded on tape. This basic series of recorded tapes was retained and two similar series of tapes were recorded to provide the variation in the rhythmic-content-variables studied.

The basic pattern for the presentation of the material on these tapes was: stimulus presentation, student response, aural or visual knowledge of results. There were three groups of taped material:

(1) the rhythm patterns were sounded by a single note struck on the piano (single tone source);

(2) the same rhythms were sounded starting on middle C on the piano and ascending diatonically for each note of the rhythm (melodic background);

(3) the rhythms were sounded on the snare drum (taps).

It was, therefore, possible to construct six separate sets of instructional materials which varied only with the variables to be investigated. In this study duple and triple rhythms have been treated as separate problems. (For an illustration of the rhythms used in this experiment, cf. Spohn, Poland 1964, Appendix C.)

Table II

Summary of Analysis of Variance of Predicted Freshman Fundamentals of Music Grades for 95 Students in Four Class Sections and in Six Experimental Groups

Class	1	2	3	4			F
Number	25	26	22	22			
Mean	2.68	2.62	2.83	2.67			.41 (df 3,91)
Experimental Treatment Group	1	2	3	4	5	6	F
Number	16	17	17	15	15	15	
Mean	2.67	2.59	2.74	2.73	2.77	2.68	.14 (df 5,89)

(with df 3,100, $F_{(.05)} = 2.70$; with df 5,89, $F_{(.05)} = 2.30$)

Equipment

Instruction took place in The Ohio State University School of Music Audio-Visual Training Laboratory. The facilities and equipment were similar to those found in many language laboratories. The tape decks were dual channel, high fidelity in quality. For this experiment, additional equipment, the Dynalevel,[1] was provided for the visual-knowledge of results treatment. Figure 2 shows the Music Audio-Visual Training Laboratory with the equipment in each booth. Figure 3 shows a student working on the rhythm tapes and receiving visual knowledge of results by means of the flashing lights of the Conn Dynalevel.

Procedure

In 1963 the first course in the fundamentals of music was taught by three different teachers in four sections. Students were assigned to classes in such a way that the classes were balanced with students in applied music (piano, voice, brass, woodwind, percussion, string) and ability as predicted by the battery of entrance tests. The students are assigned to the experimental groups in a manner similar to that used to balance the individual classes. Table II shows on the basis of predicted grades for the first quarter of the Fundamentals of Music course the four classes were not significantly different nor is the sample significantly different when divided into the six experimental groups. Once the equivalence of the experimental groups was established, they were randomly assigned to the six experimental treatments for the fall 1963 rhythm experiment as shown in the lower portion of Table II.

The Control Variables

Five items of background information, ten School of Music test scores, the appropriate pretest score were used as statistical controls in this

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[1] cf. Operation and Service Manual Conn Electronic Dynalevel, Model T-80, C. G. Conn LTD; Elkhart, Indiana (1960).

Figure 2.

Music Audio-Visual Training Laboratory with Equipment

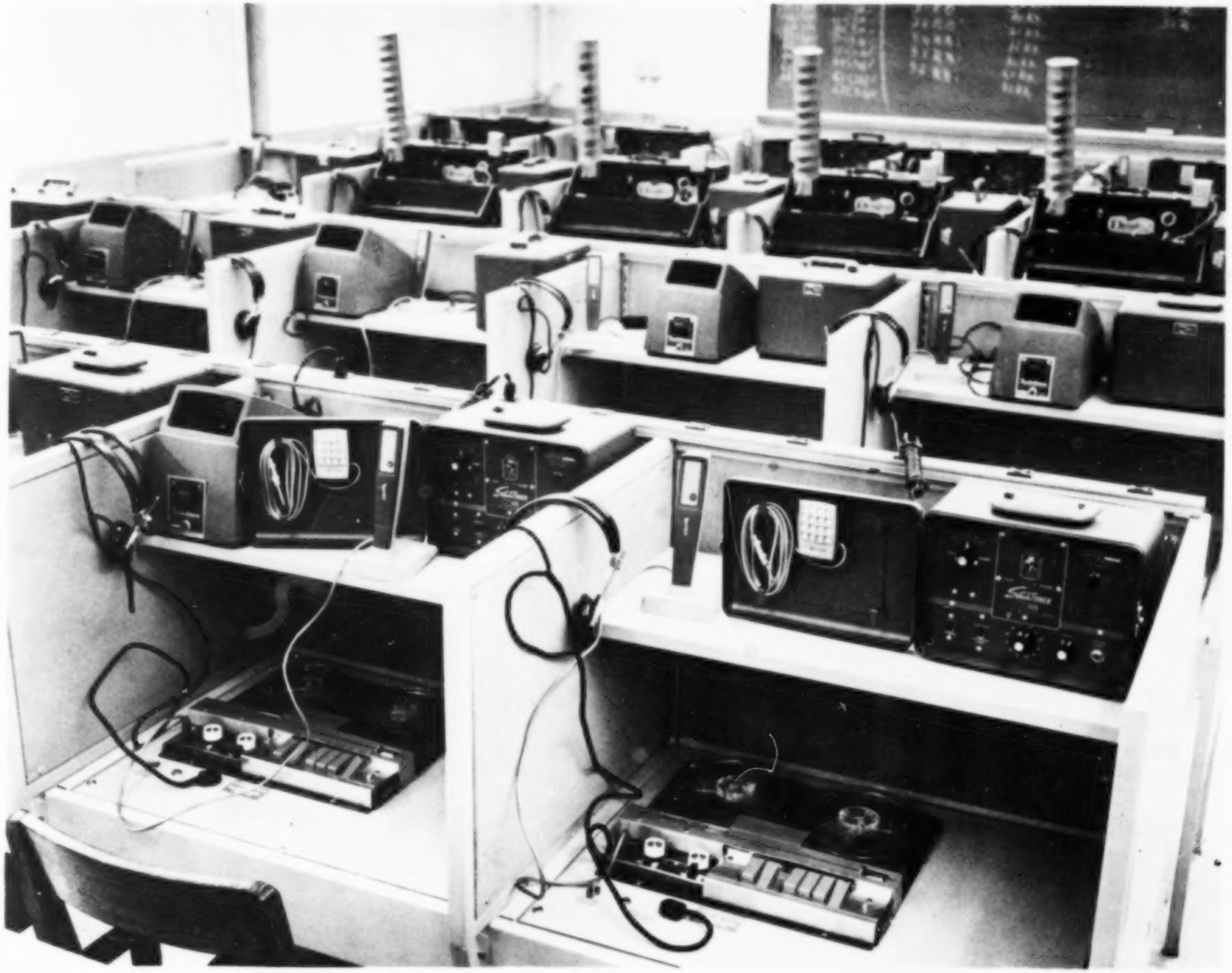
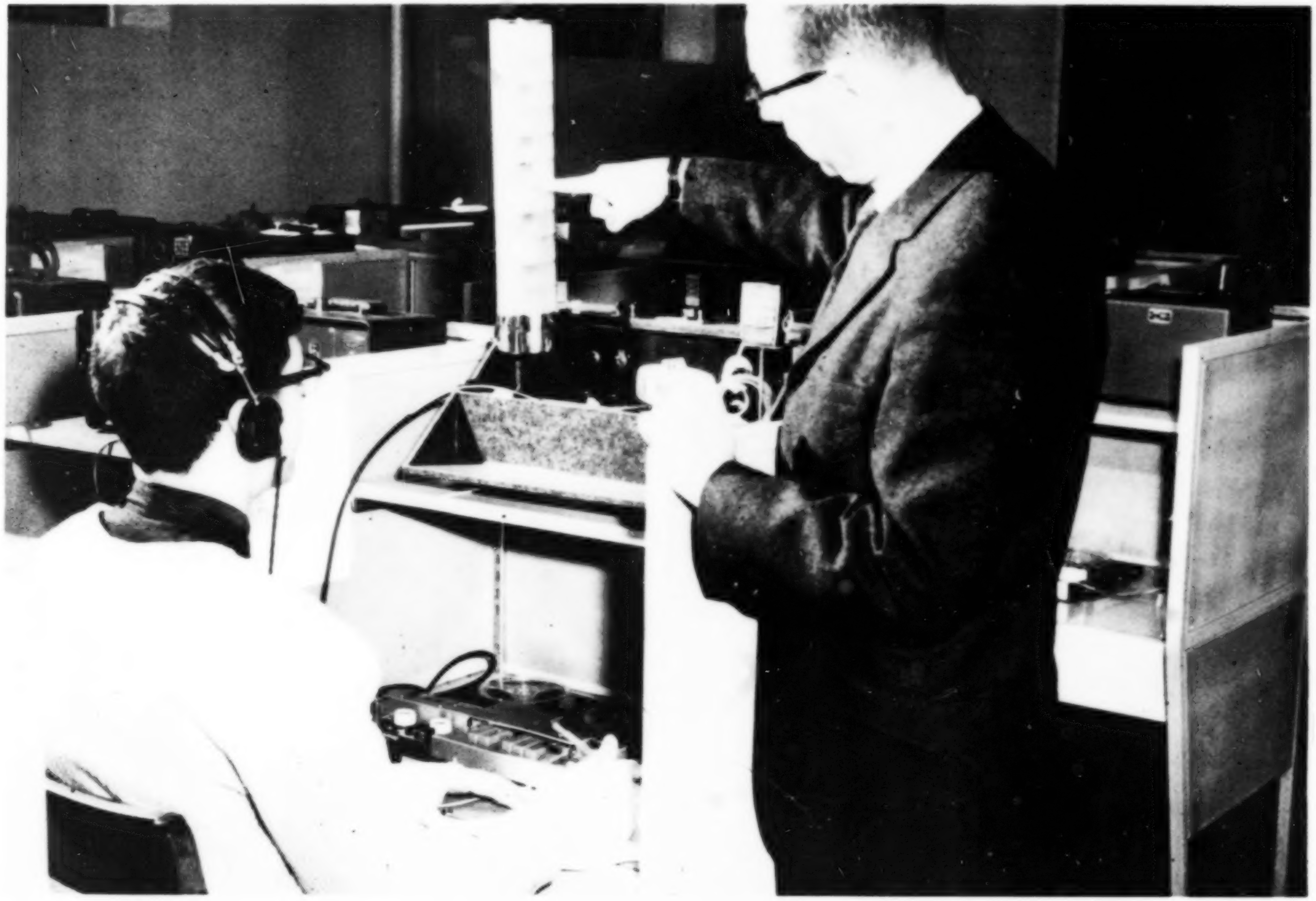


Figure 3.

The Conn Dynalevel



experiment. Added to these variables as controls was the first quarter freshman music theory grade, first quarter freshman English grade, and first quarter applied music grade. Table III is a list of these variables together with their means and standard deviations for the ninety-five experimental subjects. The combined effect of these variables was considered in each analysis of experimental treatment under Number 2, "Other Factors."

The rhythm pre-posttest was compiled from all the one hundred three-beat rhythm patterns used in the training material. There were sixty-four duple patterns and thirty-six triple patterns. Each of the one hundred three-beat rhythm patterns was recorded with single tone source, melodic background, and taps.

All ninety-five students took the same pre and posttest. In this way, it was possible to get a measure not only of the material on which they were trained, but also of tasks assigned to the other groups. The test items may be seen in Appendix D (Spohn, Poland 1964).

Table IV shows intercorrelations for rhythm pretest sections. It can be observed that there is significant positive relationships found in the pretest scores. The sections are similar items presented in different manners. If the various stimuli represented by the several test sections in the experiment were different, the interrelationships would be relatively small and the upper limit of the interrelationship would be about 50 per cent represented by a correlation coefficient of about .7. It was rather surprising that the interrelationships between the several test sections showed extremely high correlation.

The consistency of the relationships between the sections of the pre-posttests indicated similarity of the tasks of the various test sections.

All training with rhythm was undertaken in the Music Audio-Visual Training classroom as adjunctive instruction for the Music 401 Fundamentals of Music course. Students were allowed one hour per week of released time to do the required instruction in the laboratory. If they wished, the students spent more than the one hour. All training was done by means of the self-instructional tapes. The students worked in the laboratory under supervision and on a library basis. Students and laboratory staff kept a record of the amount of work covered and the scores made on each exercise. The classroom teachers were informed weekly of the progress of the students. Procedures for the use of the materials were the same used in the earlier study (Spohn, Poland 1964). The outline of procedures and experimental treatments may be seen in Figure 4.

The pretest was given to all classes at the beginning of the second week of the fall term. Training started the following week and proceeded on an individual basis for six weeks. Three groups received aural knowledge of results. They followed a procedure of listening to an item presented on the tape, made their response on a piece of paper, and then checked their answer with a pre-recorded identification of the item on the tape. The remaining three groups followed the same procedure except visual knowledge of results was given by means of flashing lights. At the end of the six-week training period, students were given a posttest.

The Analysis of the Differential Effects for the Four Experiments

Tables VI to XVII contain the analysis of the differential effects of the various experimental treatments. The parts of each table were numbered for ease of description and comparison. Number 1 was a test of the significance of the overall difference between pretest and posttest scores for all subjects. In number 2 the test of significance of the effects of the Fundamentals of Music section placement for the quarter of

Figure 4.

Procedures and Experimental Treatments for Experiment 1, Rhythm

Time Per Unit:	Four Seconds	Four Seconds	Four Seconds
Instructional Procedures:	Stimulus (Rhythm Pattern)	Response (Written)	Knowledge of Results (An aural or visual identification of the stimulus was given which enabled the student to check his response.)
EXPERIMENTAL TREATMENTS	1. The student heard a rhythm pattern on a single tone of the piano.	1. The student wrote the rhythm pattern in musical notation.	1. The student heard a pre-recorded answer which describe the stimulus in words.
	2. The student heard a rhythm pattern in a melodic background on the piano.	2. The student wrote the rhythm pattern in musical notation.	2. The student heard a pre-recorded answer which describe the stimulus in words.
	3. The student heard a rhythm pattern tapped on a snare drum.	3. The student wrote the rhythm pattern in musical notation.	3. The student heard a pre-recorded answer which describe the stimulus in words.
	4. The student heard a rhythm pattern on a single tone of the piano.	4. The student wrote the rhythm pattern in musical notation.	4. The student saw the rhythm pattern flashed on the Dynalevel.
	5. The student heard a rhythm pattern in a melodic background on the piano.	5. The student wrote the rhythm pattern in musical notation.	5. The student saw the rhythm pattern flashed on the Dynalevel.
	6. The student heard a rhythm pattern tapped on a snare drum.	6. The student wrote the rhythm pattern in musical notation.	6. The student saw the rhythm pattern flashed on the Dynalevel.

treatment being analyzed can be observed. Tests for the significance of the effect of any previous experimental treatments also will be found under number 2. The last analysis in number 2, Other Factors, was a test of the significance of the combined effect of all other control variables shown in similar tables.

Tests of significance for the experimental treatment being analyzed can be seen in number 3. This analysis consisted of separate tests for (a) the effect of differences in the manner of stimulus presentation, (b) the effect of differences in the manner of knowledge of results, and (c) the interaction of the various stimulus-knowledge of results combinations. Number 4 was the error term used as the denominator for all F tests. Simple sums of the columns as given can be found in number 5.

The actual pretest mean, posttest mean, and their difference for each of the six treatment groups and for the total number of subjects can be seen in number 6. The significance of the difference between the pre and posttest means for the total number of subjects is shown under number 1 in each table.

The posttest-pretest mean differences for the experimental groups when all of the differences attributable to the variables considered under number 2 have been removed can be seen in number 7. Since this was a measure only of differences between group means attributable to differences in experimental treatment of the groups, a constant was added to or subtracted from all the means in number 7 of a given table, so that the treatment group mean which had the smallest effect in that table was set equal to zero. This linear transformation in no way changed the magnitude or direction of the differences between groups due to differences in experimental treatment and permitted comparisons of the differences represented by these adjusted means within or between tables to be made

Table III

The Background Control Variables for the 95 Students who took part in Experiment 1, Rhythm

	Mean	Standard Deviation
Background Data		
Sex (coded 0 = male, 1 = female)	.4	.5
Age (as of date of acceptance)	18.1	3.4
Number of years of Private Study	6.3	3.5
Number of years of Piano Study	3.8	4.2
Had music theory training in high school (0 = no, 1 = yes)	.5	.5
School of Music Test Scores		
Ohio State Music Placement Test Battery		
Section I - Form VI, Aural and Notational Skills	40.7	5.4
Section II - Form II A, Music Recognition	35.7	5.9
Section III - Form IV A, General Musical Information	32.2	6.6
Ohio State Diagnostic Music Test Battery Section I - Form II, Elements of Music Theory		
Notational Speed Total	52.4	17.3
Notational Accuracy Total	55.4	16.3
Notational Output (Speed X Accuracy) Total	30.1	15.9
Aural Total	60.8	14.1
Visual Total	46.4	17.1
Entrance Audition (where E = 0, A = 4)	2.8	.9
Ohio State Psychological Examination Total Percentile Score	69.0	23.0
Grades (All grades computed with E = 0, D = 1, C = 2, B = 3, A = 4)		
First Quarter Freshman Music Theory	2.5	1.1
First Quarter Freshman English	2.1	.8
First Quarter Freshman Applied Music	2.9	.9

with minimum computation. For each of these sets of adjusted means, where at least one of the experimental treatment effects (3a, 3b, 3c) is significant at the five per cent level, the Duncan-Kramer extension of the F test for differences between pairs of means of groups of unequal sizes was applied.

The five per cent level of significance was used in this report for all analyses related to comparisons of sets of means. For the convenience of the reader all F tests significant at the five per cent level have been indicated with * and all F tests significant at the one per cent level have been indicated with **. In the Duncan-Kramer extension of the F tests, treatment group means which were not connected or underlined by the same line were significantly different at the five per cent level.

Results

One question which was asked in an experiment such as the one being reported was, "What influence does background have upon the student's ability in this kind of instruction?" Table V shows the background variables which had a significant relationship with any of the experimental pretest scores. Of these several background variables, only ten showed any relationship with the rhythm pretest scores. A small, but significant, relationship with the duple portion of the rhythm pretest was indicated with the background variable of music theory training in high school. All other relationships shown to be significant were tests used in the School of Music testing program which were included in order to increase the precision of the main effects of experimental treatments.

It has been routine in the School of Music to use these tests in investigations because their use forms a common statistical reference base. The correlations, intercorrelations, and multiple correlations which are by-products of the computer program used in analysis of variance problems

Table IV

Product-Moment Coefficients of Correlation (r) between Rhythm Pretest Scores
Number of Subjects = 93
(coefficients of correlation significant at the 1 per cent level are underlined)

	Duple Rhythm Total	Duple Rhythm Presentation with Single Tone Source	Duple Rhythm Presentation with Melodic Background	Duple Rhythm Presentation with Tape	Triple Rhythm Total	Triple Rhythm Presentation with Single Tone Source	Triple Rhythm Presentation with Melodic Background	Triple Rhythm Presentation with Tape	Duple and Triple Rhythm Presentation with Single Tone Source	Duple and Triple Rhythm Presentation with Melodic Background	Duple and Triple Rhythm Presentation with Tape	Grand Total
Duple Rhythm Total		.97	.99	.98	.85	.82	.86	.82	.96	.97	.96	.98
Duple Rhythm Presentation with Single Tone Source			.95	.92	.81	.79	.80	.78	.97	.93	.91	.95
Duple Rhythm Presentation with Melodic Background				.96	.84	.82	.83	.81	.95	.98	.95	.97
Duple Rhythm Presentation with Tape					.84	.80	.84	.82	.92	.96	.98	.97
Triple Rhythm Total						.97	.98	.97	.91	.93	.93	.96
Triple Rhythm Presentation with Single Tone Source							.93	.91	.81	.89	.88	.90
Triple Rhythm Presentation with Melodic Background								.93	.89	.93	.91	.92
Triple Rhythm Presentation with Tape									.87	.89	.93	.91
Duple and Triple Rhythm Presentation with Single Tone Source										.96	.94	.98
Duple and Triple Rhythm Presentation with Melodic Background											.97	.99
Duple and Triple Rhythm Presentation with Tape												.99
Mean	54.2	14.2	18.7	21.4	31.0	8.5	10.4	12.0	27.7	29.1	33.4	85.2
Standard Deviation	50.5	14.7	17.8	19.1	28.0	8.5	9.6	10.6	22.0	26.4	28.4	75.7

make possible a continued search for various related musical behaviors. These data, through regression analysis, might provide a basis for the selective treatment of individuals in training programs such as the ones on which these experiments were based. These data are presented as part of the analysis of the differential effects in number 2, Other Factors, and were a test of the significance of the combined effects of all other control variables.

Since the pre-posttests included all items on which students were trained, it was possible for the six treatment groups to be given the tests on tasks other than the one by which they were trained. Therefore, comparisons were made not only within groups, but between groups.

Under number 6, Table VI, scores made by the treatment groups in the duple rhythm section presented on a single tone source are shown. It is possible by comparing the pretest means and posttest means to observe from these data the similarity of each group on this task. Number 1, Grand Mean, shows the differences between pretest and posttest scores to be significant at the one per cent level which indicates overall improvement. In number 2 significance attributable to "Other Factors" which is the combined effect of all other control variables may be observed. Under number 3 there is no significant difference observable for the experimental treatment.

Experimental groups 1 and 4 received the single-tone source treatment. Groups 2, 3, 5, and 6 had the other experimental treatments. Table VII may be read similarly. Experimental groups 2 and 5 received rhythms presented with melodic background. The actual pretest and posttest means are indicated under number 6. Again, improvement significant at the one per cent level for all groups is indicated and there is a one per cent level of significance shown for the combined effect of the control variables. No significant difference is indicated for the experimental treatment. Table VIII

Table V

Product-Moment Coefficients of Correlation (r) of
Selected Background and School of Music Test Scores
with Rhythm Pretest Scores
Number of Subjects = 95
(coefficients of correlation signific[illegible]t at the 1 per cent level are underlined)

	Duple Rhythm Total	Duple Rhythm Presentation with Single Tone Source	Duple Rhythm Presentation with Melodic Background	Duple Rhythm Presentation with Tape	Triple Rhythm Total	Triple Rhythm Presentation with Single Tone Source	Triple Rhythm Presentation with Melodic Background	Triple Rhythm Presentation with Tape	Mean	Standard Deviation
Music Theory Training in High School	.28	.25	.29	.28	.23	.21	.21	.25	.5	.5
Music Placement Test Battery										
Section I, Aural and Notational Skills	.27	.24	.28	.28	.22	.22	.21	.21	40.7	3.4
Section II, Music Recognition	.26	.27	.25	.25	.27	.23	.27	.29	35.7	5.9
Section III, General Musical Information	.38	.36	.38	.37	.33	.31	.29	.36	32.2	6.6
Ohio State Psychological Examination	.28	.24	.29	.29	.30	.27	.30	.31	69.0	23.0
Diagnostic Test Battery Elements of Music Theory Total Scores										
Notation Speed	.38	.42	.38	.34	.31	.28	.31	.32	52.4	17.3
Notation Accuracy	.28	.25	.31	.26	.27	.25	.25	.30	35.4	16.3
Notation Output	.41	.42	.43	.38	.37	.33	.35	.38	30.1	15.9
Aural Recognition	.29	.26	.29	.29	.22	.22	.20	.23	60.8	14.1
Visual Recognition	.31	.27	.30	.35	.29	.28	.30	.27	46.4	17.1
Mean	54.2	14.2	18.7	21.4	31.0	8.5	10.4	12.0		
Standard Deviation	50.5	14.7	17.8	19.1	28.0	8.5	9.6	10.6		

Table VI

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple Rhythmic Presentation with Single Tone Source
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	119,617.27	1	119,617.27	788.04 **
2. Fall Quarter Fundementals of Music Section	531.66	3	177.22	1.17
Other Factors	7,798.09	16	487.38	3.21 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	204.62	1	204.62	1.35
b. (Row)[2]	501.10	2	250.55	1.65
c. Interaction	53.17	2	26.58	.18
4. Residuals	10,625.09	70	151.79	
5. Total	139,331.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	12.1	16.2	20.2	11.3	12.0	12.4	14.2
Posttest Mean	50.5	43.6	53.0	53.0	49.3	49.1	49.7
Difference	38.4	27.4	32.8	41.7	37.3	36.7	35.5

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	5	3	1	6	4
Number of Students	17	15	17	16	15	15
Adjusted Mean	0.0	5.4	6.0	7.3	8.1	9.2

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

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[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 64

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Tape, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Tape, Visual knowledge of results

Table VII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple Rhythmic Presentation with Melodic Background
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	100,311.25	1	100,311.25	838.44**
2. Fall Quarter Fundamentals of Music Section	346.61	3	115.54	.97
Other Factors	13,148.24	16	821.76	6.87**
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	109.40	1	109.40	.91
b. (Row)[2]	50.57	2	25.28	.21
c. Interaction	42.28	2	21.14	.18
4. Residuals	8,374.65	70	119.64	
5. Total	122,383.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	17.1	20.1	26.4	13.8	14.8	19.0	18.7
Posttest Mean	50.1	48.9	52.6	52.2	53.5	50.1	51.2
Difference	33.0	28.8	26.2	38.4	38.7	31.1	32.5

7. Differences between Groups due to Experimental Treatment

Treatment Group	3	2	6	1	4	5
Number of Students	17	17	15	16	15	15
Adjusted Mean	0.0	0.0	0.5	1.2	3.4	4.0

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 64

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Tape, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Tape, Visual knowledge of results

Table VIII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple Rhythmic Presentation with Taps
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

	Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1.	Grand Mean of Posttest-Pretest Differences	95,940.64	1	95,940.64	895.64**
2.	Fall Quarter Fundamentals of Music Section	569.59	3	189.86	1.77
	Other Factors	15,928.49	16	995.53	9.29**
3.	Treatment of Fall Quarter Experimental Groups				
	a. (Column)[1]	86.44	1	86.44	.81
	b. (Row)[2]	252.41	2	126.20	1.18
	c. Interaction	26.92	2	13.46	.13
4.	Residuals	7,498.51	70	107.12	
5.	Total	120,303.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	19.8	22.3	28.1	18.0	17.7	21.4	21.4
Posttest Mean	53.9	49.9	54.2	54.8	52.0	54.3	53.2
Difference	34.1	27.6	26.1	36.8	34.3	32.9	31.8

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	3	5	6	1	4
Number of Students	17	17	15	15	16	15
Adjusted Mean	0.0	1.0	2.1	4.6	5.0	5.8

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

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[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 64

[a]
1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table IX

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Total Scores for
Duple Rhythmic Presentation with Single Tone Source, Melodic Background, and Taps
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	945,405.57	1	945,405.57	915.56**
2. Fall Quarter Fundamentals of Music Section	3,832.73	3	1,277.58	1.24
Other Factors	95,971.33	16	5,998.21	5.81**
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	1,225.95	1	1,225.95	1.19
b. (Row)[2]	1,486.99	2	743.50	.72
c. Interaction	158.54	2	79.27	.08
4. Residuals	72,281.89	70	1,032.60	
5. Total	1,120,363.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	48.9	58.5	74.7	43.1	44.5	52.8	54.2
Posttest Mean	154.3	142.3	159.8	160.0	154.8	153.5	154.0
Differences	105.4	83.8	85.1	116.9	110.3	100.7	99.8

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	3	5	6	1	4
Number of Students	17	17	15	15	16	15
Adjusted Mean	0.0	6.6	11.7	12.9	13.7	18.9

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 2

[b] Total possible score 192

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table X

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Triple Rhythmic Presentation with Single Tone Source
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	30,028.64	1	30,028.64	704.90**
2. Fall Quarter Fundamentals of Music Section	121.16	3	40.39	.95
Other Factors	2,414.16	16	150.88	3.54**
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	2.11	1	2.11	.05
b. (Row)[2]	159.28	2	79.64	1.87
c. Interaction	161.32	2	80.66	1.89
4. Residuals	2,982.33	70	42.60	
5. Total	35,869.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3.	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	7.6	10.4	9.4	6.7	7.5	9.3	8.5
Posttest Mean	27.1	24.5	27.6	27.7	26.8	24.2	26.3
Difference	19.5	14.1	18.2	21.0	19.3	14.9	17.8

7. Difference between Groups due to Experimental Treatment

Treatment Group	6	2	5	3	1	4
Number of Students	15	17	15	17	16	15
Adjusted Mean	0.0	1.4	3.6	4.4	5.4	6.1

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 36

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XI

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Triple Rhythmic Presentation with Melodic Background
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	28,001.69	1	28,001.69	847.25**
2. Fall Quarter Fundamentals of Music Section	79.21	3	26.40	.80
Other Factors	4,337.34	16	271.08	8.20**
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	9.18	1	9.18	.28
b. (Row)[2]	16.84	2	8.42	.25
c. Interaction	91.31	2	45.66	1.38
4. Residuals	2,313.43	70	33.05	
5. Total	34,849.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	9.4	12.0	12.7	8.9	8.1	10.9	10.4
Posttest Mean	27.7	25.9	28.4	27.3	29.2	27.0	27.6
Difference	18.3	13.9	15.7	18.4	21.1	16.1	17.2

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	3	4	1	5
Number of Students	17	15	17	15	16	15
Adjusted Mean	0.0	0.5	1.7	2.1	2.8	3.6

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 36

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XII

Analysis of Variance and Covariance of Aural Stimulus-Written Response Triple Rhythmic Presentation with Taps Scores of 95 Subjects in Six Groups of Various Sizes (F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	28,173.64	1	28,173.64	962.87**
2. Fall Quarter Fundamentals of Music Section	57.41	3	19.14	.65
Other Factors	5,574.97	16	348.44	11.91**
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	.09	1	.09	$<.01$
b. (Row)[2]	46.36	2	23.18	.79
c. Interaction	35.17	2	17.58	.60
4. Residuals	2,048.36	70	29.26	
5. Total	35,936.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	12.1	13.1	13.7	11.3	9.3	12.3	12.0
Posttest Mean	30.2	27.3	39.9	29.9	29.4	28.9	29.2
Difference	18.1	14.2	16.2	18.6	20.1	16.6	17.2

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	3	5	4	1
Number of Students	17	15	17	15	15	16
Adjusted Mean	0.0	1.0	1.8	1.9	2.2	3.2

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 36

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XIII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Triple Rhythmic Presentation with Single Tone Source, Melodic Background, and Taps
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	258,546.69	1	258,546.69	935.44**
2. Fall Quarter Fundamentals of Music Section	824.08	3	274.69	.99
Other Factors	31,137.05	16	1,946.07	7.04**
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	9.60	1	9.60	.03
b. (Row)[2]	518.37	2	259.18	.94
c. Interaction	692.63	2	346.32	1.25
4. Residuals	19,347.58	70	276.39	
5. Total	311,076.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	29.1	35.5	35.8	26.9	24.9	32.5	31.0
Posttest Mean	85.0	77.7	85.9	84.9	85.4	80.1	83.2
Difference	55.9	42.2	50.1	53.0	60.5	47.6	52.2

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	3	5	4	1
Number of Students	17	15	17	15	15	16
Adjusted Mean	0.0	0.1	6.1	8.0	9.0	9.9

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 108

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XIV

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Total Scores for
Duple and Triple Rhythmic Presentation with Single Tone Source
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

	Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1.	Grand Mean of Posttest Pretest Differences	269,511.58	1	269,511.58	879.03**
2.	Fall Quarter Fundamentals of Music Section	1,002.69	3	334.23	1.09
	Other Factors	15,052.93	16	940.81	3.07**
3.	Treatment of Fall Quarter Experimental Groups				
	a. (Column)[1]	183.47	1	183.47	.60
	b. (Row)[2]	1,045.36	2	522.68	1.70
	c. Interaction	296.14	2	148.07	.48
4.	Residuals	21,461.83	70	306.60	
5.	Total	308,554.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	19.8	26.5	29.5	18.0	19.5	21.7	22.7
Posttest Mean	77.7	68.0	80.6	80.7	76.0	73.2	76.0
Differences	57.9	41.5	51.1	62.7	56.5	51.5	53.3

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	5	3	1	4
Number of Students	17	15	15	17	16	15
Adjusted Mean	0.0	6.7	7.6	8.3	11.4	13.8

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 100

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XV

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple and Triple Rhythmic Presentation with Melodic Background
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	234,310.78	1	234,310.78	969.03**
2. Fall Quarter Fundamentals of Music Section	776.43	3	258.81	1.07
Other Factors	27,146.46	16	1,696.65	7.02**
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	199.67	1	199.67	.83
b. (Row)[2]	150.64	2	75.32	.31
c. Interaction	248.32	2	124.16	.51
4. Residuals	16,925.70	70	241.80	
5. Total	279,758.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	26.5	32.1	39.1	22.7	22.9	29.9	29.1
Posttest Mean	77.8	74.8	81.0	79.5	82.8	77.2	78.8
Difference	51.3	42.7	41.9	56.8	59.9	47.3	49.7

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	3	1	4	5
Number of Students	17	15	17	16	15	15
Adjusted Mean	0.0	0.8	1.4	4.1	5.9	7.7

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 100

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XVI

Analysis of Variance and Covariance of Aural Stimulus-Written Response
Duple and Triple Rhythmic Presentation with Taps
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	228,095.00	1	228,095.00	1,034.26**
2. Fall Quarter Fundamentals of Music Section	1,010.18	3	336.73	1.53
Other Factors	34,222.65	16	2,138.92	9.70**
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	96.70	1	96.70	.44
b. (Row)[2]	507.47	2	253.74	1.15
c. Interaction	63.09	2	31.54	.14
4. Residuals	15,437.91	70	220.54	
5. Total	279,433.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	31.8	35.4	41.8	29.3	26.9	33.7	33.4
Posttest Mean	84.0	77.2	84.1	84.7	81.3	83.2	82.4
Difference	52.2	41.8	42.3	55.4	54.4	49.5	49.0

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	3	5	6	4	1
Number of Students	17	17	15	15	15	16
Adjusted Mean	0.0	2.8	4.1	5.6	8.0	8.2

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 100

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XVII

Analysis of Variance and Covariance of Aural Stimulus-Written Response
Duple and Triple Rhythmic Presentation with
Single Tone Source, Melodic Background, and Tape
Scores of 95 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	2,192,752.52	1	2,192,752.52	1,025.36 **
2. Fall Quarter Fundamentals of Music Section	7,895.91	3	2,631.97	1.23
Other Factors	202,589.35	16	12,661.83	5.92 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	1,513.32	1	1,513.32	.71
b. (Row)[2]	3,738.43	2	1,869.22	.87
c. Interaction	1,383.07	2	691.54	.32
4. Residuals	149,696.40	70	2,138.52	
5. Total	2,559,569.00	95		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	16	17	17	15	15	15	95
Pretest Mean[b]	78.1	94.0	110.5	70.0	69.3	85.3	85.2
Posttest Mean	239.5	220.0	245.7	244.9	240.1	233.6	237.1
Difference	161.4	126.0	135.2	174.9	170.8	148.3	151.9

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	3	6	5	1	4
Number of Students	17	17	15	15	16	15
Adjusted Mean	0.0	12.3	12.9	19.7	23.8	28.3

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 300

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Tape, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Tape, Visual knowledge of results

shows a similar pattern. These scores and analysis show an evaluation of the learning of rhythms by taps sounded on the snare drum. Treatment groups 3 and 6 had this training. Again, overall improvement (Grand Mean, number 1) was significant at the one per cent level. The control variables are shown to be significant at the one per cent level. There was no significant difference due to any experimental treatment. In Table IX a pattern similar to that observed in the previous tables is seen when all duple scores for all groups are totaled. Tables X through XIII showing the data and analysis of scores for triple rhythms indicate the same pattern already established and observed in the duple portion of this experiment. When duple and triple scores were combined in Tables XIV through XVII a similar pattern was observed. It is therefore concluded that with this sample that:

(1) students, as a result of this training, did make improvement in their ability to hear and to write rhythms correctly;

(2) the combined effects of all other control variables were in each portion of the analyses significant in the student's improvement;

(3) there was no evidence that a particular kind of rhythmic presentation or a particular kind of aural or visual knowledge of results was any more or less effective than any other in order to achieve effective learning. One cannot say that rhythms presented with taps, single tone source, or melodic background was a more effective learning procedure than another; nor was there any evidence that either aural or visual knowledge of results was a better method for learning rhythm.

A Second Analysis of the Data

Since Phase I of the study included three different experiments and was carried out as part of the required course sequence of the Fundamentals of Music, it was not possible to retain the 95 subjects throughout the academic year. Unpredictable attrition makes the prior determination of final groups

Table XVIII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple Rhythmic Presentation with Single Tone Source
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Diffetences	92,327.19	1	92,327.19	730.73 **
2. Fall Quarter Fundamentals of Music Section	289.61	3	96.54	.76
Other Factors	6,638.90	18	368.83	2.92 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	53.85	1	53.85	.43
b. (Row)[2]	1,047.62	2	523.81	4.15 *
c. Interaction	314.29	2	157.14	1.24
4. Residuals	5,306.54	42	126.35	
5. Total	105,978.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	13.2	17.3	22.7	11.9	13.4	12.9	15.6
Posttest Mean	55.9	44.9	57.7	53.5	55.0	48.9	52.2
Difference	42.7	27.6	35.0	41.6	41.6	36.0	36.6

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	5	6	4	1	3
Number of Students	15	7	11	13	10	13
Adjusted Mean	0.0	9.5	10.6	13.3	13.3	13.3

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 64

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XIX

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple Rhythmic Presentation with Melodic Background
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	76,333.70	1	76,333.70	913.63 **
2. Fall Quarter Fundamentals of Music Section	259.83	3	86.61	1.04
Other Factors	10,451.41	18	580.63	6.95 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	29.79	1	29.79	.36
b. (Row)[2]	176.68	2	88.34	1.06
c. Interaction	185.29	2	92.64	1.11
4. Residuals	3,509.30	42	83.55	
5. Total	90,946.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	19.3	20.7	29.8	15.2	17.1	18.8	20.5
Posttest Mean	54.6	50.6	57.0	54.4	58.0	50.2	53.8
Differences	35.3	29.9	27.2	39.2	40.9	31.4	33.3

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	3	1	5	4
Number of Students	15	11	13	10	7	13
Adjusted Mean	0	1.9	5.4	5.6	6.1	7.5

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total Possible Score 64

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Tape, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Tape, Visual knowledge of results

Table XX

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple Rhythmic Presentation with Taps
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	72,459.36	1	72,459.36	974.70 **
2. Fall Quarter Fundamentals of Music Section	281.29	3	93.76	1.26
Other Factors	14,882.24	18	826.79	11.12 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	13.27	1	13.27	.18
b. (Row)[2]	518.58	2	259.29	3.49 *
c. Interaction	31.92	2	15.96	.21
4. Residuals	3,122.34	42	74.34	
5. Total	91,309.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	23.4	23.7	31.1	19.4	18.7	20.4	23.2
Posttest Mean	58.4	51.5	58.0	56.2	55.4	55.2	55.6
Difference	35.0	27.8	26.9	36.8	36.7	34.8	32.4

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	5	3	6	4	1
Number of Students	15	7	13	11	13	10
Adjusted Mean	0	3.5	6.8	7.0	8.7	8.9

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 64

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic Background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XXI

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Triple Rhythmic Presentation with Single Tone Source
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	23,893.57	1	23,893.57	1,099.06 **
2. Fall Quarter Fundamentals of Music Section	107.69	3	35.90	1.65
Other Factors	2,079.21	18	115.51	5.31 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	45.91	1	45.91	2.11
b. (Row)[2]	362.01	2	181.00	8.33 **
c. Interaction	358.37	2	179.18	8.24 **
4. Residuals	913.24	42	21.74	
5. Total	27,760.00			

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	9.9	11.1	10.3	7.3	8.9	6.4	9.1
Posttest Mean	30.7	25.1	31.0	28.3	30.0	22.4	27.7
Difference	20.8	14.0	20.7	21.0	21.1	16.0	18.6

7. Differences between Groups due to Experimental Treatment

Treatment Group	6	2	5	4	1	3
Number of Students	11	15	7	13	10	13
Adjusted Mean	0	.7	4.7	7.2	8.4	9.2

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 36

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Tape, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Tape, Visual knowledge of results

Table XXII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple Rhythmic Presentation with Single Tone Source, Melodic Background, and Taps
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	721,348.19	1	721,348.19	950.31 **
2. Fall Quarter Fundamentals of Music Section	2,240.44	3	746.81	.98
Other Factors	86,777.63	18	4,820.98	6.35 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	277.95	1	277.95	.37
b. (Row)[2]	4,558.52	2	2,279.26	3.00
c. Interaction	1,270.48	2	635.24	.84
4. Residuals	31,880.79	42	759.07	
5. Total	848,354.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	55.9	61.7	83.5	46.5	49.3	52.2	59.3
Posttest Mean	168.9	147.0	172.6	164.1	168.4	154.5	161.5
Differences	113.0	85.3	89.1	117.6	119.1	102.3	102.2

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	5	6	3	1	4
Number of Students	15	7	11	13	10	13
Adjusted Mean	0.0	19.0	19.1	25.3	27.8	29.6

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 192

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XXIII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Triple Rhythmic Presentation with Melodic Background
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	20,248.17	1	20,248.17	872.01 **
2. Fall Quarter Fundamentals of Music Section	109.53	3	36.51	1.57
Other Factors	3,945.34	18	219.19	9.44 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	19.39	1	19.39	.84
b. (Row)[2]	125.51	2	62.76	2.70
c. Interaction	233.95	2	116.98	5.04 *
4. Residuals	975.11	42	23.22	
5. Total	25,657.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	12.8	13.0	15.0	9.5	8.7	8.4	11.5
Posttest Mean	30.5	26.3	31.2	27.8	31.7	26.1	28.6
Difference	17.7	13.3	16.2	18.3	23.0	17.7	17.1

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	4	5	3	1
Number of Students	15	11	13	7	13	10
Adjusted Mean	0	.2	3.4	4.9	6.0	6.3

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 36

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XXIV

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Triple Rhythmic Presentation with Taps
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	22,104.71	1	22,104.71	1,390.23 **
2. Fall Quarter Fundamentals of Music Section	85.00	3	28.33	1.78
Other Factors	4,247.75	18	235.99	14.84 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	29.10	1	29.10	1.83
b. (Row)[2]	124.20	2	62.10	3.91 *
c. Interaction	160.57	2	80.28	5.05 *
4. Residuals	667.67	42	15.90	
5. Total	27,419.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	15.2	14.3	15.8	12.2	8.4	9.0	12.9
Posttest Mean	33.3	28.2	33.2	30.2	32.4	28.8	30.8
Difference	18.1	13.9	17.4	18.0	24.0	19.8	17.9

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	4	5	3	1
Number of Students	15	11	13	7	13	10
Adjusted Mean	0	.3	2.8	3.8	5.1	6.2

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 36

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

2

Table XXV

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Triple Rhythmic Presentation with Single Tone Source, Melodic Background, and Tape
Scores of 69 Subjects in Six Groups of Various Sizes

(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

	Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1.	Grand Mean of Posttest-Pretest Differences	198,513.06	1	198,513.06	1,316.40 **
2.	Fall Quarter Fundamentals of Music Section	929.81	3	309.94	2.06
	Other Factors	27,084.40	18	1,504.69	9.98 **
3.	Treatment of Fall Quarter Experimental Groups				
	a. (Column)[1]	248.13	1	248.13	1.65
	b. (Row)[2]	1,625.00	2	813.50	5.39 **
	c. Interaction	2,145.07	2	1,072.54	7.11 **
4.	Residuals	6,333.53	42	150.80	
5.	Total	236,879.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	37.9	38.4	41.1	29.1	26.0	23.7	33.5
Posttest Mean	94.5	79.6	95.4	86.4	94.1	77.3	87.1
Difference	56.6	41.2	54.3	57.3	68.1	53.6	53.6

7. Differences between Groups due to Experimental Treatment

Treatment Group	6	2	4	5	3	1
Number of Students	11	15	13	7	13	10
Adjusted Mean	0	.2	12.7	13.4	19.7	20.2

Adjusted Means which are not connected by the same line are significantly different at the 5 per cent level

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 108

[a]
1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Tape, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Tape, Visual knowledge of results

Table XXVI

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple and Triple Rhythmic Presentation with Single Tone Source
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	210,157.45	1	210,157.45	976.98 **
2. Fall Quarter Fundamentals of Music Section	565.95	3	188.65	.88
Other Factors	13,195.87	18	733.10	3.41 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	.00	1	.00	.00
b. (Row)[2]	2,592.11	2	1,296.06	6.03 **
c. Interaction	1,265.91		632.96	2.94
4. Residuals	9,034.71	42	215.11	
5. Total	236,812.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	23.1	28.4	33.0	19.2	22.3	19.3	24.7
Posttest Mean	86.6	70.0	88.7	81.8	85.0	71.3	79.9
Differences	63.5	41.6	55.7	62.6	62.7	52.0	55.2

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	5	4	1	3
Number of Students	15	11	7	13	10	13
Adjusted Mean	0	9.3	13.2	19.8	21.3	21.4

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 100

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XXVII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple and Triple Rhythmic Presentation with Melodic Background
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source			Sum of Squares	Degrees of Freedom		Mean Square	F
1. Grand Mean of Posttest-Pretest Differences			175,210.57	1		175,210.57	1,069.99 **
2. Fall Quarter Fundamentals of Music Section			614.35	3		204.78	1.25
Other Factors			23,488.98	18		1,304.96	7.97 **
3. Treatment of Fall Quarter Experimental Groups							
a. (Column)[1]			1.55	1		1.55	.01
b. (Row)[2]			619.70	2		309.85	1.89
c. Interaction			808.34	2		404.17	2.47
4. Residuals			6,877.51	42		163.75	
5. Total			207,621.00	69			
6. Means and Differences between Means							
Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	32.1	33.7	44.8	24.7	25.9	27.2	32.0
Posttest Mean	85.1	76.9	88.2	82.2	89.8	76.4	82.4
Difference	53.0	43.2	43.4	57.5	63.9	49.2	50.4
7. Differences between Groups due to Experimental Treatment							
Treatment Group	2	6	5	4	3	1	
Number of Students	15	11	7	13	13	10	
Adjusted Mean	0	2.0	11.0	11.2	11.3	12.0	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 100

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Tape, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Tape, Visual knowledge of results

Table XXVIII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Duple and Triple Rhythmic Presentation with Taps
Scores of 69 Subjects in Six Groups of Various Sizes

(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	174,606.39	1	174,606.39	1,293.48 **
2. Fall Quarter Fundamentals of Music Section	581.27	3	193.76	1.44
Other Factors	30,505.97	18	1,694.78	12.55 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	.62	1	.62	4.01
b. (Row)[2]	1,140.84	2	570.42	4.23 *
c. Interaction	339.44	2	169.72	1.26
4. Residuals	5,669.47	42	134.99	
5. Total	212,844.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	38.6	38.0	46.8	31.6	27.1	29.4	36.1
Posttest Mean	91.7	79.7	91.1	86.4	87.8	84.0	86.4
Difference	53.1	41.7	44.3	54.8	60.7	54.6	50.3

7. Differences between Groups due to Experimental Treatment

Treatment Group	2	6	5	4	3	1
Number of Students	15	11	7	13	13	10
Adjusted Mean	0	7.5	7.6	11.7	12.0	15.1

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 100

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

Table XXIX

Analysis of Variance and Covariance of Aural Stimulus-Written Response
Duple and Triple Rhythmic Presentation with
Single Tone Source, Melodic Background, and Taps
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	1,676,688.93	1	1,676,688.93	1,215.98 **
2. Fall Quarter Fundamentals of Music Section	4,881.73	3	1,627.24	1.18
Other Factors	185,500.60	18	10,305.59	7.47 **
3. Treatment of Fall Quarter Experimental Groups				
a. (Column)[1]	.72	1	.72	4.01
b. (Row)[2]	11,781.90	2	5,890.95	4.27 *
c. Interaction	6,689.01	2	3,344.50	2.43
4. Residuals	57,913.11	42	1,378.88	
5. Total	1,943,456.00	69		

6. Means and Differences between Means

Fall Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	10	15	13	13	7	11	69
Pretest Mean[b]	93.8	100.1	124.6	75.5	75.3	75.9	92.8
Posttest Mean	263.4	226.6	268.0	250.4	262.6	231.7	248.7
Difference	169.6	126.5	143.4	174.9	187.3	155.8	155.9

7. Differences between Groups due to Experimental Treatment

Treatment Groups	2	6	5	4	3	1
Number of Students	15	11	7	13	13	10
Adjusted Mean	0	18.4	32.0	42.7	44.4	48.0

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 300

[a] 1. Single tone source, Aural knowledge of results
2. Melodic background, Aural knowledge of results
3. Taps, Aural knowledge of results
4. Single tone source, Visual knowledge of results
5. Melodic background, Visual knowledge of results
6. Taps, Visual knowledge of results

impossible. Most of the attrition in the freshman course sequence in the Fundamentals of Music takes place by the beginning of the second quarter There was, however, some attrition between the second and third quarter. Normal academic attrition reduced the total number of students completing the third quarter of the Fundamentals of Music to 69 students. Since it was possible that this remaining group of students might reflect some differences other than the total sample which began and completed the fall quarter (the 95 students), a second analysis of the data was undertaken.

The following twelve tables, XVIII to XXIX, show the analysis of variance and covariance of the rhythm study for the 69 subjects that completed the entire sequence. It may be observed that there is a somewhat different pattern in this analysis than the data reported for the 95 students. Eight of the twelve tables, XIX, XXI, XXIII, XXIV, XXV, XXVI, XXVIII, and XXIX, show differential effect due to experimental treatment of rhythmic stimulus presentation. Four of the analyses, XXI, XXIII, XXIV, and XXV, indicate a significant differential effect due to the interaction of row and column. Five of the analyses indicate a differential effect due to experimental treatment including the Grand Total of all rhythm scores. These data indicate the single tone source was more effective and that taps was almost but not quite as effective as a method of stimulus presentation for rhythms.

These data clearly indicate that, for the 69 subjects who continued throughout the entire freshman year, the experimental treatment for rhythms presented both on a single tone source and taps was superior. Melodic background as a method for learning rhythm alone was a less effective presentation when compared with the other methods.

Discussion

Six inferences arise from these results.

First, inspection of the pretest means indicate that students were not very proficient with the task of transcribing rhythms before training regardless of the way in which rhythms were presented. Posttest means in all instances showed improvement. From the data it was apparent that students came into the School of Music as music majors with little skill or knowledge of the task of transcribing rhythms.

Second, the notion that a particular kind of rhythmic presentation for learning to transcribe rhythms was superior to another was not supported except for those students who continued through the freshman year as music majors. Maximum scores were not achieved, however, for any group in any of the sections. In view of the significance shown in "Other Factors" the point is emphasized that individual differences brought about by individual backgrounds contributed to a student's learning.

Third, it was surprising that the method of knowledge of results did not play an important part in the learning of rhythms in this experiment. There was no evidence that aural knowledge of results was more or less efficient than visual knowledge of results for groups learning rhythms. Perhaps the difference was individual whereby students found a certain inclination toward withdrawal or use of a particular method of training due to individual preference.

Fourth, there is every reason to believe from a comparison of the two analyses (the one with the 95 students and the second with the 69) that there was a difference in the people who completed the freshman year when compared with those who dropped out through normal attrition. These differences, however, were not reflected in the means and standard deviations of the control variables. For those students who continued through the freshman year of music, it was apparent that different experimental treatments did have greater differential effectiveness.

Fifth, the analyses indicate that the single tone source method for rhythmic presentation was the most effective method and facilitated the learning of rhythm. The data supported the position that taps as a means of rhythmic presentation was also an effective method and facilitated the learning of rhythm. Both methods were more useful methods than the one which utilized a melodic background. The interaction reported in several of the analyses between columns and rows of the experimental design suggests the possibility of some small effect due to aural or visual knowledge of results.

The explanation of this interaction effect is not clear. There was no reason to believe, however, that either aural or visual knowledge of results with any one of the rhythmic presentations was superior. The interaction effect might be explained in terms of the individual differences among students and how they reacted to a particular method of instruction.

Sixth, there was no evidence that either of the two methods of providing knowledge of results was more useful than the other in learning a particular rhythmic presentation.

Table XXX

Product-Moment Coefficients of Correlation (r) between Rhythm Pretest Scores
Number of Subjects = 69
(coefficients of correlation significant at the 1 per cent level are underlined)

	Duple Rhythm Total	Duple Rhythm Presentation With Single Tone Source	Duple Rhythm Presentation With Melodic Background	Duple Rhythm Presentation With Tape	Triple Rhythm Total	Triple Rhythm Presentation With Single Tone Source	Triple Rhythm Presentation With Melodic Background	Triple Rhythm Presentation With Tape	Duple and Triple Rhythm Presentation With Single Tone Source	Duple and Triple Rhythm Presentation With Melodic Background	Duple and Triple Rhythm Presentation With Tape	Grand Total
Duple Rhythm Total		.97	.99	.98	.87	.84	.86	.84	.96	.98	.97	.99
Duple Rhythm Presentation with Single Tone Source			.96	.92	.84	.83	.83	.80	.98	.94	.91	.93
Duple Rhythm Presentation with Melodic Background				.92	.86	.84	.86	.83	.94	.98	.92	.97
Duple Rhythm Presentation with Tape					.86	.82	.85	.83	.92	.96	.98	.92
Triple Rhythm Total						.97	.98	.98	.92	.93	.93	.96
Triple Rhythm Presentation with Single Tone Source							.93	.91	.93	.90	.88	.91
Triple Rhythm Presentation with Melodic Background								.94	.90	.94	.92	.93
Triple Rhythm Presentation with Tape									.88	.89	.93	.91
Duple and Triple Rhythm Presentation with Single Tone Source										.96	.94	.98
Duple and Triple Rhythm Presentation with Melodic Background											.97	.99
Duple and Triple Rhythm Presentation with Tape												.99
Mean	50.3	15.6	20.5	23.2	33.5	9.[illegible]	11.5	12.9	24.7	32.0	36.1	92.8
Standard Deviation	53.3	15.6	18.8	19.9	28.4	8.5	9.9	10.7	23.1	27.8	29.4	79.2

Table XXXI

Product-Moment Coefficients of Correlation (r) of
Selected Background and School of Music Test Scores
with Rhythm Pretest Scores
Number of Subjects = 69
(coefficients of correlation significant at the 1 per cent level are underlined)

	Duple Rhythm Total	Duple Rhythm Presentation with Single Tone Source	Duple Rhythm Presentation with Melodic Background	Duple Rhythm Presentation with Tape	Triple Rhythm Total	Triple Rhythm Presentation with Single Tone Source	Triple Rhythm Presentation with Melodic Background	Triple Rhythm Presentation with Tape	Duple and Triple Rhythm Presentation with Single Tone Source	Duple and Triple Rhythm Presentation with Melodic Background	Duple and Triple Rhythm Presentation with Tape	Grand Total	Mean	Standard Deviation
Music Theory Training in High School	.33	.28	.33	.35	.28	.28	.27	.27	.29	.38	.36	.32	.6	.5
Aural and Notational Skills	.37	.33	.37	.37	.32	.38	.29	.29	.36	.35	.35	.36	41.3	5.1
General Musical Information	[illegible]	.38	.40	.36	.31	.32	.27	.32	.37	.36	.36	.37	32.8	6.6
Notational Speed	.43	.46	.44	.39	.41	.39	.42	.32	.43	.44	.41	.44	52.4	15.1
Notation Accuracy	.30	.26	.31	.29	.29	.27	.27	.30	.28	.31	.31	.30	57.1	16.6
Notation Output	.42	.42	.44	.39	.42	.40	.41	.40	.43	.46	.41	.43	31.1	15.3
Aural Recognition	.31	.27	.34	.30	.27	.29	.24	.25	.29	.31	.30	.30	60.4	14.3
Visual Recognition	.32	.25	.31	.35	.32	.34	.30	.29	.29	.32	.34	.33	49.2	16.4
Mean	39.3	15.6	20.5	23.2	33.5	9.1	11.5	12.9	24.7	32.0	36.1	92.8		
Standard Deviation	53.3	15.6	18.8	19.9	28.4	8.5	9.9	10.7	23.1	28.8	29.4	79.2		

Table XXXII

Product-Moment Coefficients of Correlation (r) Between Time Spent in Experimental Rhythm Treatment and Rhythm Posttest-Pretest Difference Scores

Number of Subjects = 69

(coefficients of correlation significant at the 1 per cent level are underlined)

	Posttest minus Pretest Difference Duple Rhythm Total	Posttest minus Pretest Difference Duple Rhythm Presentation with Single Tone Source	Posttest minus Pretest Difference Duple Rhythm Presentation with Melodic Background	Posttest minus Pretest Difference Duple Rhythm Presentation with Tape	Posttest minus Pretest Difference Triple Rhythm Total	Posttest minus Pretest Difference Triple Rhythm Presentation with Single Tone Source	Posttest minus Pretest Difference Triple Rhythm Presentation with Melodic Background	Posttest minus Pretest Difference Triple Rhythm Presentation with Tape	Posttest minus Pretest Difference Duple and Triple Rhythm Presentation with Single Tone Source	Posttest minus Pretest Difference Duple and Triple Rhythm Presentation with Melodic Background	Posttest minus Pretest Difference Duple and Triple Rhythm Presentation with Tape	Posttest minus Pretest Difference Grand Total	Mean	Standard Deviation
Number of practices on Tape 10	.46	.29	.42	.52	.27	.13	.23	.36	.25	.38	.50	.40	1.9	1.2
Total Number of Practice Tapes	.47	.29	.49	.34	.34	.26	.29	.40	.30	.45	.53	.45	21.6	11.2

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PART III

PHASE I, EXPERIMENT NUMBER 2, INTERVALS

Introduction

In music instruction, students are required to learn the relationship between different pitches. One relationship which is traditionally taught is that of a music interval. A music interval is defined as the relationship between two different fixed tones. Pitch relationships which exist in music remain constant and have characteristic sounds and fixed names. Pitch relationships exist between two tones sounded alternately, starting with the lower tone and followed by the upper tone. Such a relationship is called an ascending melodic interval. Another pitch relationship exists between two tones when the upper tone is sounded first and is followed by the sounding of the lower tone. This relationship is called a descending melodic interval. A third pitch relationship is that of two tones sounded simultaneously; the resultant sound is a harmonic interval.

All three of these characteristic sounds are considered separate learning tasks in traditional music instruction. Although there has been testing of the level of competency of students in the three methods of interval presentation, little has been done to test the competencies and knowledge acquired by the students when instructed by only one of the three possible presentations. Past research (Spohn, Poland 1964) investigated the learning of the accurate identification of ascending melodic intervals. Earlier research in interval training (Spohn 1962) indicated that students improved in their ability to identify ascending melodic intervals from a mean of 44% accuracy to a mean of 84% accuracy. This research indicated that for some students but not all students the skill of identifying melodic ascending intervals accurately assisted the student in his ability to identify intervals presented in descending melodic or harmonic form.

The 1964 research in interval learning provided the opportunity to observe that students who had difficulty in learning intervals were not always able to identify the appropriateness of their response. This was especially true of the instructional methods which involved sung and spoken responses to aural stimuli. Even though it was reported (Spohn, Poland 1964) that this particular instructional method of interval presentation was overall the most effective method of interval learning for ascending melodic intervals, there were students who after responding were not able to identify the difference between a correct and incorrect voice response. As a result of this observation, there was an obvious need to give students alternate methods for knowledge of results. This study was intended to answer major questions about the presentation of the basic music element, intervals, and to investigate alternative methods, either aural or visual, for providing knowledge of results. Specifically, this study was to determine:

(1) whether the use of a particular method of interval presentation facilitated the learning of intervals,

(2) whether one method of interval presentation was more useful overall than any other,

(3) whether a particular method of knowledge of results, either aural or visual, facilitated learning any of the three interval presentations, and

(4) whether one method of providing knowledge of results was more useful than another in learning a particular interval presentation.

METHOD

Subjects

The subjects for this experiment were the same students who had entered The Ohio State University School of Music in the fall 1963 and who were enrolled in the second quarter Fundamentals of Music class. At the beginning of this period of instruction there were eighty-three students enrolled in the four sections of the Fundamentals of Music class taught by three teachers. Since attrition makes the prior determination of group sizes impossible, it was necessary to establish a plan by which different groups could be utilized throughout the academic year. Past research (Spohn, Poland 1964, p. 35) established the pattern which had been found successful in specifying the experimental groups for this experiment.

Materials

The materials for this study were based on those used in past research (Spohn, Poland 1964, Appendices A and B) and had been researched and programed using the ascending melodic method of presentation. The procedure for recording the three interval methods on the tape was similar to that specified in the rhythm study; that is: a stimulus was presented, there was time for student response, and information was given so that the student could compare his answer (knowledge of results).

The basic method used was aural presentation and voiced response. Past research (Spohn, Poland 1964) had shown this procedure to be a more effective method than traditional class instruction. Pre and posttests used in the above research were satisfactory. It was therefore decided to continue the use of these tests, since they included both written and voiced responses for all the three different interval presentations. Table XXXII shows the correlations of the several interval pretest scores. It may be observed that in most cases there is a high correlation between the several sections of the interval pretest.

The equipment used in this portion of the study was basically the same as that used in the rhythm experiment; that is, all training took place in the Music Audio-Visual Training Laboratory. The students continued to use

Table XXXIII

Product-Moment Coefficients of Correlation (r) between Interval Pretest Scores
Number of Subjects = 83
(coefficients of correlation significant at the 1 per cent level are underlined)

	Total Written Responses	Ascending Melodic Written Response	Descending Melodic Written Response	Harmonic Written Response	Total Voice Responses	Ascending Melodic Visual Stimulus Voice Response	Descending Melodic Visual Stimulus Voice Response	Ascending Melodic Aural Stimulus Voice Response	Descending Melodic Aural Stimulus Voice Response	Harmonic Aural Stimulus Voice Response
Total Written Responses		.73	.84	.79	.72	.56	.55	.68	.66	.69
Ascending Melodic Written Response			.74	.67	.77	.62	.58	.74	.75	.66
Descending Melodic Written Response				.78	.80	.62	.63	.71	.75	.77
Harmonic Written Response					.70	.53	.48	.64	.67	.71
Total Voice Responses						.87	.84	.89	.92	.86
Ascending Melodic Visual Stimulus Voice Response							.84	.68	.69	.61
Descending Melodic Visual Stimulus Voice Response								.62	.67	.61
Ascending Melodic Aural Stimulus Voice Response									.82	.73
Descending Melodic Aural Stimulus Voice Response										.81
Mean	89.4	14.4	11.6	10.4	38.8	6.9	6.0	11.4	9.2	5.2
Standard Deviation	21.4	5.2	5.5	5.8	24.3	5.5	4.6	6.2	5.9	5.5

the individual booths with the taped-interval material on an individual basis. The major difference in equipment in this portion of the study was that the students who were assigned to the visual knowledge of results group were given, in addition to the tape decks, an individual pitch measuring machine, the Conn Strobotuner.[2] The Conn Strobotuner is a piece of equipment that was designed primarily for use with music instruments to measure pitch. It was believed that this piece of equipment would be useful in providing some students with knowledge of results of their vocal response. Figure 5 shows a student in a booth with one of the Strobotuners on the right hand side of the picture. The piece of equipment on the student's left is the Tachitron which was used in Experiment 3. The student was able to voice his response which was recorded on the magnetic tape and in addition check this response by looking at the Conn Strobotuner which visually showed the accuracy of the student's sung pitch. The students who were assigned to the aural knowledge of results treatment heard the stimulus repeated and were given the correct verbal identification of the interval.

Procedure

All students were enrolled in the second quarter Fundamentals of Music classes at The Ohio State University. Students were assigned to the experimental treatment groups on the basis of past practice (Spohn, Poland 1964, p. 35). Pretests were given at the end of the first week of the instructional period. Instruction began the following week. Students used the Music Audio-Visual Training Laboratory on a one-hour released time basis. Each experimental treatment group was assigned the same amount of training.

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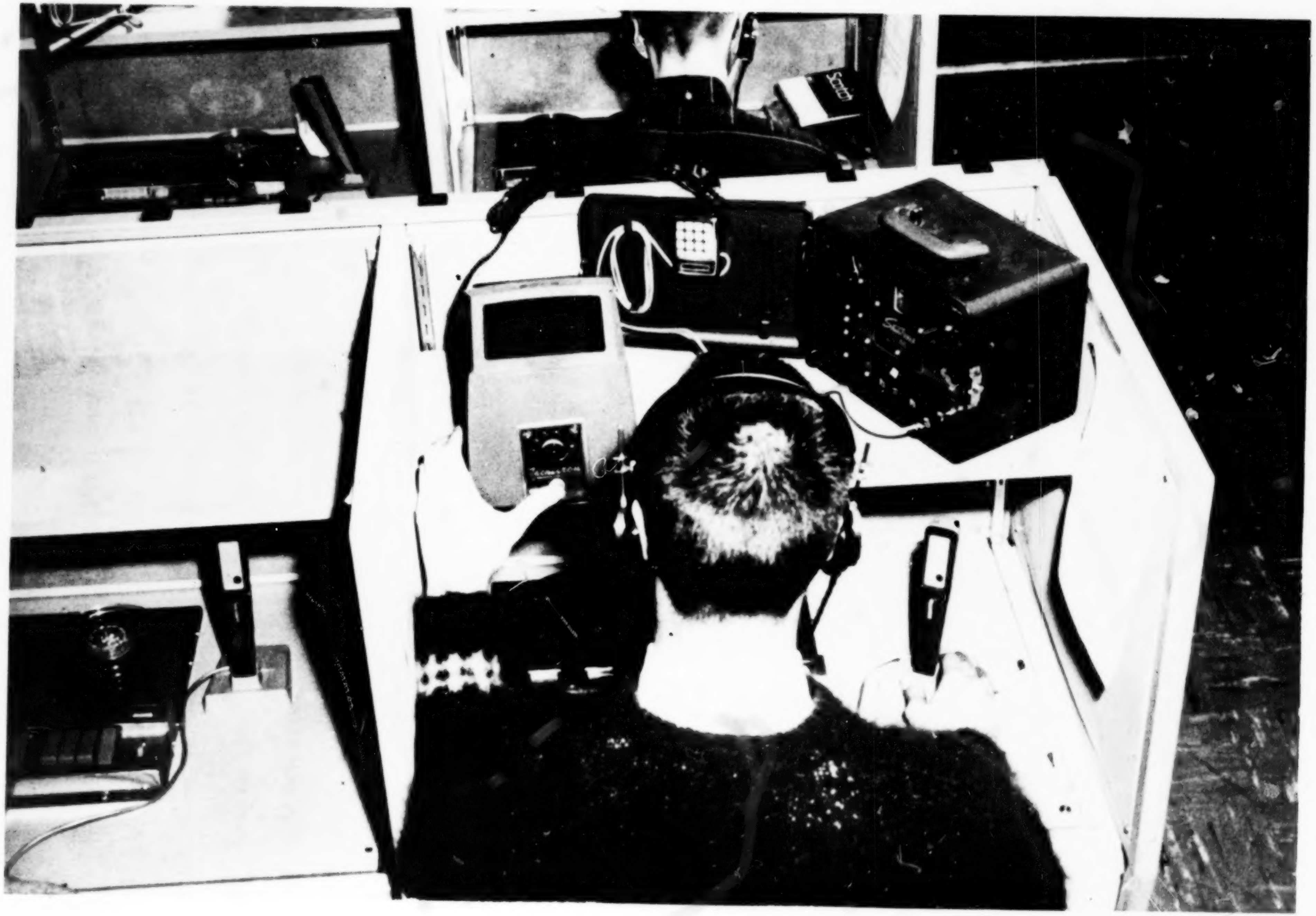
[2] cf. Strobotuner Operation and Service Manual, C. G. Conn LTD., Elkhart, Indiana.

Figure 5.

The Conn Strobotuner



The outline of procedures and experimental treatments may be seen in Figure 6.

Control Variables

The background control variables are shown in Table XXXIV. Table XXXV shows the relationship between the control variables and the pretest scores. These data show a somewhat different pattern than had been observed in the correlation of background scores for the rhythm experiment. For the interval test two of the pretest sections show a relationship with the number of years of private study. General Musical Information, Section III also was indicated as a significant correlation with three of the pretest sections.

Since the students had been in the fall quarter Fundamentals of Music class, it was expected that this previous instruction would show a relationship with sections of the interval pretest. In addition, students had some studied applied music instruction which also showed a small but significant correlation with two of the pretest sections in which students made a written response.

There was a six-week training period for the students after which posttests were given. Students worked on an individual basis. Student work and progress was supervised. Student progress in the laboratory training was reported each week to the classroom teacher.

Students' voiced responses were recorded on tape. These individual responses were checked by graduate assistants after students finished an exercise. The students kept their own record of scores made on each exercise; they could repeat exercises on which they needed additional work. There was no attempt to control the amount of time each student spent on the material. There was an effort made, however, to obtain a criterion level which meant that no more than two errors on any exercise were

Figure 6.

Procedures and Experimental Treatments for Experiment 2, Intervals

Time Per Unit:	Four Seconds	Four Seconds	Four Seconds
Instructional Procedures:	Stimulus (Intervals	Response	Knowledge of Results (An aural or visual identification of the stimulus was given which enabled the student to check his response.)
EXPERIMENTAL TREATMENTS	1. The student heard an ascending melodic interval.	1. The student sang the interval and identified it.	1. The student heard the interval again and then a description of the stimulus in words.
	2. The student heard a descending melodic interval.	2. The student sang the interval and identified it.	2. The student heard the interval again and then a description of the stimulus in words.
	3. The student heard a harmonic interval.	3. The student sang the interval and identified it.	3. The student heard the interval again and then a description of the stimulus in words.
	4. The student heard an ascending melodic interval.	4. The student sang the interval and identified it.	4. The student simultaneously checked the pitch of his response with the Strobotuner.
	5. The student heard a descending melodic interval.	5. The student sang the interval and identified it.	5. The student simultaneously checked the pitch of his response with the Strobotuner.
	6. The student heard a harmonic interval.	6. The student sang the interval and identified it.	6. The student simultaneously checked the pitch of his response with the Strobotuner.

Table XXXIV

The Background Control Variables for the 83 Students who took part in Experiment 2, Intervals

	Mean	Standard Deviation
Background Data		
Sex (coded 0 = male, 1 = female)	.4	.5
Age (as of date of acceptance)	18.2	3.6
Number of years of Private Study	6.5	3.5
Number of years of Piano Study	4.1	4.4
Had music theory training in high school (0 = no, 1 = yes)	.6	.5
School of Music Test Scores		
Ohio State Music Placement Test Battery		
Section I - Form VI, Aural and Notational Skills	41.1	5.3
Section II - Form II A, Music Recognition	36.0	5.7
Section III - Form IV A, General Musical Information	32.5	6.6
Ohio State Diagnostic Music Test Battery Section I - Form II, Elements of Music Theory		
Notational Speed Total	52.2	16.9
Notational Accuracy Total	59.6	16.1
Notational Output (Speed X Accuracy) Total	30.8	15.7
Aural Total	61.1	14.2
Visual Total	47.6	16.5
Entrance Audition (where E = 0, A = 4)	2.9	.9
Ohio State Psychological Examination Total Percentile Score	68.7	23.3
Grades (All grades computed with E = 0, D = 1, C = 2, B = 3, A = 4)		
First Quarter Freshman Music Theory	2.6	1.0
First Quarter Freshman English	2.0	.8
First Quarter Freshman Applied Music	3.0	.8

TABLE XXXV

Product-Moment Coefficients of Correlation (r) of Selected Background, School of Music Test Scores, and First Quarter Course Grades with Interval Pretest Scores

Number of Subjects = 83

(coefficients of correlation significant at the 1 per cent level are underlined)

	Total Written Responses	Ascending Melodic Written Response	Descending Melodic Written Response	Harmonic Written Response	Total Voice Responses	Ascending Melodic Visual Stimulus Voice Response	Descending Melodic Visual Stimulus Voice Response	Ascending Melodic Aural Stimulus Voice Response	Descending Melodic Aural Stimulus Voice Response	Harmonic Aural Stimulus Voice Response	Mean	Standard Deviation
Number of years of Private Study	.24	.13	.21	.18	.20	.12	.15	.15	.16	.32	6.5	3.5
Number of years of Piano Study	.18	.11	.13	.30	.18	.16	.09	.11	.12	.29	4.1	4.6
Music Placement Test Battery												
Section I, Aural and Notational Skills	.43	.35	.52	.36	.52	.51	.45	.38	.47	.48	41.1	5.3
Section II, Music Recognition	.25	.16	.21	.15	.24	.19	.16	.30	.23	.16	36.0	5.7
Section III, General Musical Information	.25	.23	.14	.05	.40	.19	.13	.32	.18	.05	32.5	6.6
Diagnostic Test Battery Elements of Music Theory Total Scores												
Notation Speed	.37	.20	.15	.21	.13	.09	.02	.16	.16	.12	52.2	16.9
Notation Accuracy	.30	.30	.19	.16	.11	.14	.03	.13	.13	.02	56.9	16.1
Notation Output	.41	.39	.19	.23	.14	.12	.02	.18	.16	.09	30.8	13.7
Aural Recognition	.44	.44	.47	.47	.47	.53	.42	.72	.66	.58	61.1	14.2
Visual Recognition	.48	.33	.39	.41	.34	.38	.34	.24	.25	.31	47.6	16.5
Course Grades												
* One Quarter of Freshman Music Theory	.37	.34	.41	.31	.34	.27	.24	.37	.30	.28	2.6	1.0
One Quarter of Private Study	.32	.18	.32	.15	.25	.26	.21	.20	.25	.16	3.0	0.8
Mean	89.4	16.4	11.4	10.4	38.0	6.9	6.0	11.4	9.2	5.2		
Standard Deviation	21.4	5.2	5.5	5.8	24.3	5.5	6.6	6.2	5.9	5.5		

permitted on a final trial. If the student did make more than two errors the exercise was repeated.

Results

Each experimental treatment group was given complete pre and posttests which involved the task on which they were trained as well as the tasks on which the other experimental groups were trained. It was, therefore, possible to make comparisons with the achievement of the total experimental groups (cf. Figure 1 p. 8).

In Table XXXVI, under number 6, Treatment Groups, the group which trained with ascending melodic intervals combined with aural knowledge of results was group 1; group 4 trained with ascending melodic intervals and visual knowledge of results. The other groups received the alternative methods of instruction. Number 1, Grand Mean, in Table XXXVI indicates that an improvement significant at the one per cent level was made by all groups on this particular test section.

Number 2 indicates that background factors were significant at the one per cent level in the improvement on this task. Number 3, however, reveals that there were differential effects due to experimental treatment significant at the one per cent level. The presentation method of ascending melodic intervals was the best treatment. Number 7 reflects the differences between means due to experimental treatment. It may be observed that groups 1 and 4 were the experimental groups most improved. The adjusted means for those two groups are significantly different at the five per cent level from the other four groups. There is no evidence to indicate that either aural or visual knowledge of results was a significant factor in the training of these students.

Table XXXVII is an analysis of the descending intervals with voice response section of the test. This was the training given to experimental

Table XXXVI

Analysis of Variance and Covariance of Aural Stimulus-Sung Response Ascending Melodic Interval Presentation Scores of 83 Subjects in Six Groups of Various Sizes (F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest - Pretest Differences	2,428.93	1	2,428.93	215.90 **
2. Fall Quarter Experimental Treatment	37.34	5	7.47	.66
Winter Quarter Fundamentals of Music Section	60.90	3	20.30	1.80
Other Factors	1,092.99	19	57.53	5.11 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	.33	1	.33	.03
b. (Row)[2]	237.05	2	118.52	10.54 **
c. Interaction	56.76	2	28.38	2.52
4. Residuals	562.70	50	11.25	
5. Total	4,477.00			

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group [a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	11.4	13.1	10.8	12.1	11.9	9.2	11.4
Posttest Mean	20.2	14.8	16.1	19.1	15.7	14.8	16.8
Difference	8.8	1.7	5.3	7.0	3.8	5.6	5.4

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	2	5	3	6	4	1
Number of Students	14	14	13	13	14	15
Adjusted Mean	0.0	2.0	2.3	2.8	5.0	7.5

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XXXVII

Analysis of Variance and Covariance of
Aural Stimulus-Sung Response
Descending Melodic Interval Presentation
Scores of 83 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

	Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1.	Grand Mean of Posttest-Pretest Differences	2,075.00	1	2,075.00	156.49 **
2.	Fall Quarter Experimental Treatment	35.79	5	7.16	.54
	Winter Quarter Fundamentals of Music Section	51.65	3	17.22	1.30
	Other Factors	615.76	19	32.41	2.44 **
3.	Treatment of Winter Quarter Experimental Groups				
	a. (Column)[1]	20.65	1	20.65	1.56
	b. (Row)[2]	24.12	2	12.06	.91
	c. Interaction	47.26	2	23.63	1.78
4.	Residuals	662.77	50	13.26	
5.	Total	3,533.00	83		

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	9.7	9.6	8.5	10.8	9.4	7.2	9.2
Posttest Mean	15.8	14.2	13.0	14.3	15.4	12.5	14.2
Difference	6.1	4.6	4.5	3.5	6.0	5.3	5.0

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	3	2	6	4	1	5
Number of Students	13	14	13	14	15	14
Adjusted Mean	0.0	0.4	0.8	1.2	1.9	3.7

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XXXVIII

Analysis of Variance and Covariance of
Aural-Stimulus-Sung Response
Harmonic Interval Presentation
Scores of 83 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	1,113.45	1	1,113.45	78.58 **
2. Fall Quarter Experimental Treatment	73.23	5	14.65	1.03
Winter Quarter Fundamentals of Music Section	11.94	3	3.98	.28
Other Factors	403.78	19	21.25	1.50
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	10.31	1	10.31	.73
b. (Row)[2]	93.16	2	46.58	3.29 *
c. Interaction	17.52	2	8.76	.62
4. Residuals	708.61	50	14.17	
5. Total	2,432.00	83		

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	5.9	6.1	3.8	6.3	5.8	3.3	5.2
Posttest Mean	8.1	7.3	9.8	10.7	9.1	8.6	8.9
Difference	2.2	1.2	6.0	4.4	3.3	5.3	3.7

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	2	5	1	6	4	3
Number of Students	14	14	15	13	14	13
Adjusted Mean	0.0	2.0	3.0	3.9	4.3	4.4

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XXXIX

Analysis of Variance and Covariance of
Visual Stimulus-Sung Response
Ascending Melodic Interval Presentation
Scores of 83 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	3,435.61	1	3,435.61	286.30**
2. Fall Quarter Experimental Treatment	42.83	5	8.57	.71
Winter Quarter Fundamentals of Music Section	11.36	3	3.79	.32
Other Factors	935.50	19	49.24	4.10**
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	.69	1	.69	.06
b. (Row)[2]	63.14	2	31.57	2.63
c. Interaction	18.87	2	9.44	.79
4. Residuals	600.00	50	12.00	
5. Total	5,108.00	83		

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	7.7	8.6	6.4	5.3	7.8	5.2	6.9
Posttest Mean	14.9	13.7	12.3	14.3	11.9	12.4	13.3
Difference	7.2	5.1	5.9	9.0	4.1	7.2	6.4

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	5	3	2	6	4	1
Number of Students	14	13	14	13	14	15
Adjusted Mean	0.0	0.9	1.1	2.2	2.6	3.8

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XL

Analysis of Variance and Covariance of Visual Stimulus-Sung Response Descending Melodic Interval Presentation Scores of 83 Subjects in Six Groups of Various Sizes (F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	1,409.20	1	1,409.20	171.23 **
2. Fall Quarter Experimental Treatment	32.42	5	6.48	.79
Winter Quarter Fundamentals of Music Section	7.37	3	2.46	.30
Other Factors	741.22	19	39.01	4.74 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	3.78	1	3.78	.46
b. (Row)[2]	51.56	2	25.78	3.13
c. Interaction	4.94	2	2.47	.30
4. Residuals	411.51	50	8.23	
5. Total	2,662.00	83		

6. Means and Differences between Means of Test Scores							
Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	7.1	7.9	5.2	4.9	5.9	4.8	6.0
Posttest Mean	9.9	11.7	10.4	10.3	9.1	9.3	10.1
Difference	2.8	3.8	5.2	5.4	3.2	4.5	4.1

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups						
Treatment Group	5	1	4	2	6	3
Number of Students	14	15	14	14	13	13
Adjusted Mean	0.0	0.7	0.7	1.2	2.9	3.2

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

groups 2 and 5. The means of all groups may be observed under number 6. It may be observed that overall improvement on this task and "Other Factors," the combined background of students, were significant at the one per cent level. There is no evidence to support that there were any differential effects due to any experimental treatment. Number 7 indicates that differences between means, due to experimental treatments, do not exist. Experimental treatment group number 5, however, showed the greatest amount of improvement. There was no evidence that any of the differences between the six experimental group means were significant.

In Table XXXVIII, the evaluation of the harmonic interval presentation may be observed. Groups 3 and 6 were the treatment groups which received harmonic interval training with aural knowledge of results (group 3) and harmonic interval training with visual knowledge of results (group 6). The improvement of all the experimental groups on their ability to accurately voice and identify harmonic intervals was significant at the one per cent level. The fall quarter experimental treatment, winter quarter fundamentals of music section, or the background factors did not effect the improvement scores. The manner in which intervals were presented is shown to have differential effects in the improvement on this task significant at the five per cent level. The differences observed between the scores of the groups were due to experimental treatment. In number 7, it may be seen that the adjusted means for treatment groups 3, 4, 6, 1, and 5 are not significantly different. The adjusted means of experimental group number 2 is significantly different at the five per cent level than experimental groups 3, 4, and 6.

Tables XXXIX and XL were submitted as part of this report because these test sections represent tasks which were closely related to the students' training but were not part of the training. This was an external measure of the effects of experimental treatment. The test task was to see a given

Table XLI

Analysis of Variance and Covariance of
Visual and Aural Stimulus-Sung Response
Ascending Melodic, Descending Melodic, and Harmonic Interval Presentation
Scores of 83 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	50,533.78	1	50,533.78	427.20 **
2. Fall Quarter Experimental Treatment	81.26	5	16.25	.14
Winter Quarter Fundamentals of Music Section	426.78	3	142.26	1.20
Other Factors	5,272.65	19	277.51	2.35 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	52.12	1	52.12	.44
b. (Row)[2]	1,042.69	2	521.34	4.41 *
c. Interaction	114.07	2	57.04	.48
4. Residuals	5,914.65	50	118.29	
5. Total	63,438.00	83		

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	41.8	45.2	34.8	39.3	40.7	29.7	38.8
Posttest Mean	69.5	61.6	61.7	68.5	60.7	57.6	63.5
Difference	27.7	16.4	26.9	29.2	20.0	27.9	24.7

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	2	5	3	6	4	1
Number of Students	14	14	13	13	14	15
Adjusted Mean	0.0	4.9	10.5	12.2	12.3	13.7

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 120

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XLII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Ascending Melodic Interval Presentation
Scores of 83 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	789.59	1	789.59	122.99 **
2. Fall Quarter Experimental Treatment	46.40	5	9.28	1.45
Winter Quarter Fundamentals of Music Section	141.99	3	47.33	7.37 **
Other Factors	566.62	19	29.82	4.64 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	8.51	1	8.51	1.33
b. (Row)[2]	110.91	2	55.46	8.64 **
c. Interaction	8.95	2	4.48	.70
4. Residuals	321.03	50	6.42	
5. Total	1,994.00	83		

6. Means and Differences between Means

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	15.6	15.7	12.8	15.4	13.6	13.1	14.4
Posttest Mean	19.3	16.9	17.3	19.8	16.3	14.9	17.5
Difference	3.7	1.2	4.5	4.4	2.7	1.8	3.1

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	6	5	2	3	1	4
Number of Students	13	14	14	13	15	14
Adjusted Mean	0.0	1.4	1.6	1.8	4.5	4.5

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XLIII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Descending Melodic Interval Presentation
Scores of 83 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	985.49	1	985.49	89.75 **
2. Fall Quarter Experimental Treatment	59.93	5	11.99	1.09
Winter Quarter Fundamentals of Music Section	58.43	3	19.48	1.77
Other Factors	575.90	19	30.31	2.76 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	2.14	1	2.14	.19
b. (Row)[2]	4.29	2	2.14	.19
c. Interaction	6.79	2	3.40	.31
4. Residuals	549.03	50	10.98	
5. Total	2,242.00	83		

6. Means and Differences between Means

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	11.4	11.1	10.9	12.9	11.7	10.0	11.4
Posttest Mean	14.9	15.7	14.4	15.7	14.9	13.0	14.8
Difference	3.5	4.6	3.5	2.8	3.2	3.0	3.4

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	3	4	6	5	2	1
Number of Students	13	14	13	14	14	15
Adjusted Mean	0.0	0.1	0.4	0.5	1.1	1.4

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XLIV

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Harmonic Interval Presentation
Scores of 83 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	599.14	1	599.14	37.47 **
2. Fall Quarter Experimental Treatment	28.93	5	5.79	.36
Winter Quarter Fundamentals of Music Section	9.38	3	3.13	.20
Other Factors	1,013.99	19	53.37	3.34 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	7.41	1	7.41	.46
b. (Row)[2]	65.48	2	32.74	2.05
c. Interaction	21.18	2	10.59	.66
4. Residuals	799.49	50	15.99	
5. Total	2,545.00	83		

6. Means and Differences between Means

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	15	14	13	14	14	13	83
Pretest Mean[b]	11.0	11.0	8.8	11.4	12.0	7.7	10.4
Posttest Mean	12.8	11.9	14.5	13.4	13.1	12.8	13.1
Difference	1.8	0.9	5.7	2.0	1.1	5.1	2.7

7. Differences between Meand due to Experimental Treatment of Winter Quarter Groups

Treatment Group	2	5	1	4	6	3
Number of Students	14	14	15	14	13	13
Adjusted Mean	0.0	2.2	2.4	3.2	3.8	4.3

Adjusted means not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

interval notation, hear a reference pitch, and make a voice response by singing and identifying the interval. It may be observed in both tables that students did make gains in these tasks even though there was no specific training. The background variables are shown to be significant at the one per cent level. There was no evidence that there was any differential effects due to any of the six experimental treatments.

Table XL shows the analysis and total scores for all the voice response items for the six treatment groups on five test sections. These scores represent actual performance tasks of music majors on 120 intervals. Overall improvement is shown for all groups. Other Factors, the combined effect of all background, is shown to be significant at the one per cent level. Differential effects due to experimental treatment is shown to be significant at the five per cent level. Number 7 indicates that both treatments, (1) ascending melodic intervals with either aural or visual knowledge of results or (2) the harmonic intervals with either aural or visual knowledge of results, produced the best overall improvement in students' ability to hear and identify intervals accurately. The ordering shows the ascending melodic interval treatment to be slightly better than the harmonic interval treatment. These treatments, however, were significantly different.

Tables XLII, XLIII, and XLIV were given because this information was part of the complete test given to the six treatment groups. Three test sections called for a written response. Students heard an interval aurally and wrote the identification of the interval. Table XLII shows the analysis for ascending interval-written response scores; Table XLIII shows the analysis for descending interval-written response scores; Table XLIV shows the analysis for the harmonic interval-written response scores. Only in Table XLII was there any evidence of differential effect due to experimental treatment. Experimental treatment groups 1 and 4 were improved in their ability to write the correct intervals. The difference due to experimental treatment is significant at the one per cent level. In each of the tables, however, it may be observed that students did improve in their ability to write intervals. Data shown in Table XLII indicate that training in singing ascending melodic intervals contributed toward the students' ability to write ascending melodic intervals. The other experimental treatments did not parallel this improvement on similar tests.

A Second Analysis of the Data

A second analysis of the data was reported for the Rhythm Experiment. Because there was evidence from an analysis of the 69 students who finished the freshman year as music majors in the sequence which showed differential effectiveness resulting from the experimental treatment, a second analysis of the data for the Interval Experiment was advisable. The following nine tables, XLV to LIII, show the analysis of variance and covariance of the interval study for the 69 subjects who completed the entire sequence. Only three of the analyses, Tables XLVII, XLVIII, and L, show results different than those previously reported for the total sample of 83 students.

Table XLVII shows a five per cent significant level reported for the fall quarter experimental treatment. In Table XLVIII, a five per cent significant level may be observed for the differential effects of the experimental treatment. It may be observed from the data that the means of those students who received the experimental treatment of ascending melodic intervals are higher so that the improvement is significantly different than the other groups. Table L varies only in that the row effect, the experimental treatment, in this case is reported at the one per cent significant level rather than the five per cent level which had been reported for the 83 students.

Table XLV

Analysis of Variance and Covariance of
Aural Stimulus-Sung Response
Ascending Melodic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	2,103.78	1	2,103.78	187.50 **
2. Fall Quarter Experimental Treatment	60.27	2	30.14	2.69
Winter Quarter Fundamentals of Music Section	68.28	3	22.76	2.03
· Other Factors	848.07	21	40.38	3.60 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	.08	1	.08	.01
b. (Row)[2]	271.50	2	135.75	12.10 **
c. Interaction	8.82	2	4.41	.39
4. Residuals	415.20	37	11.22	
5. Total	3,776.00	69		

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	11.7	14.9	11.3	11.4	10.7	8.8	11.5
Posttest Mean	20.5	16.0	16.1	19.0	15.1	14.8	17.0
Difference	8.8	1.1	4.8	7.6	4.4	6.0	5.5

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	2	5	3	6	4	1
Number of Students	12	11	10	12	11	13
Adjusted Mean	0	.6	1.1	1.8	5.2	6.8

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 26

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XLVI

Analysis of Variance and Covariance of
Aural Stimulus-Sung Response
Descending Melodic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	2,005.57	1	2,005.57	140.45 **
2. Fall Quarter Experimental Treatment	17.63	2	8.82	.62
Winter Quarter Fundamentals of Music Section	23.51	3	7.84	.55
Other Factors	658.12	21	31.34	2.19 *
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	2.65	1	2.65	.19
b. (Row)[2]	4.60	2	2.30	.16
c. Interaction	16.77	2	8.38	.59
4. Residuals	528.47	37	14.28	
5. Total	3,250.00	69		

6. Means and Differences between Means

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	9.7	10.7	8.4	10.4	8.6	7.1	9.2
Posttest Mean	16.0	15.5	13.0	14.8	15.2	12.6	14.6
Difference	6.3	4.8	4.6	4.4	6.6	5.5	5.4

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	3	2	6	4	5	1
Number of Students	10	12	12	11	11	13
Adjusted Mean	0	0.1	0.8	1.2	2.2	2.4

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XLVII

Analysis of Variance and Covariance of
Aural Stimulus-Sung Response
Harmonic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	935.01	1	935.01	79.71 **
2. Fall Quarter Experimental Treatment	79.31	2	39.66	3.38 *
Winter Quarter Fundamentals of Music Section	9.49	3	3.16	.27
Other Factors	370.07	21	17.62	1.50
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	2.12	1	2.12	.18
b. (Row)[2]	109.51	2	54.76	4.67 *
c. Interaction	14.53	2	7.26	.62
4. Residuals	433.96	37	11.73	
5. Total	1,956.00	69		

6. Means and Differences between Means							
Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	6.0	6.9	3.9	6.4	5.4	3.0	5.3
Posttest Mean	8.1	8.2	10.1	11.0	8.3	8.5	9.0
Difference	2.1	1.3	6.2	4.6	2.9	5.5	3.7
7. Differences between Means due to Experimental Treatment of Winter Quarter Groups							
Treatment Group	2	5	1	4	6	3	
Number of Students	12	11	13	11	12	10	
Adjusted Mean	0	2.1	2.9	3.2	4.9	5.7	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 26

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Tape, Visual knowledge of results

Table XLVIII

Analysis of Variance and Covariance of
Visual Stimulus-Sung Response
Ascending Melodic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	2,960.93	1	2,960.93	232.59 **
2. Fall Quarter Experimental Treatment	9.53	2	4.76	.37
Winter Quarter Fundamentals of Music Section	57.24	3	19.08	1.50
Other Factors	677.29	21	32.25	2.53 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	.85	1	.85	.07
b. (Row)[2]	114.67	2	57.34	4.50 *
c. Interaction	30.52	2	15.26	1.20
4. Residuals	470.97	37	12.73	
5. Total	4,322.00			

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	7.8	9.8	6.9	4.2	7.4	5.1	6.9
Posttest Mean	15.1	14.5	12.9	13.9	12.0	12.1	13.5
Differences	7.3	4.7	6.0	9.7	4.6	7.0	6.6

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	3	2	5	6	4	1
Number of Students	10	12	11	12	11	13
Adjusted Mean	0	0.7	0.9	1.5	3.1	6.0

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a]
1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table XLIX

Analysis of Variance and Covariance of
Visual Stimulus-Sung Response
Descending Melodic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	1,193.75	1	1,193.75	129.61 **
2. Fall Quarter Experimental Treatment	2.75	2	1.38	.15
Winter Quarter Fundamentals of Music Section	10.83	3	3.61	.39
Other Factors	707.51	21	33.69	3.66 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	4.58	1	4.58	.50
b. (Row)[2]	24.81	2	12.40	1.35
c. Interaction	2.12	2	1.06	.12
4. Residuals	340.65	37	9.21	
5. Total	2,287.00	69		

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	7.4	9.0	5.3	4.6	5.8	5.0	6.3
Posttest Mean	10.1	12.7	10.6	10.6	9.4	9.2	10.4
Difference	2.7	3.7	5.3	5.9	3.6	4.2	4.2

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	5	2	4	6	3	1
Number of Students	17	12	11	12	10	13
Adjusted Mean	0	1.1	1.3	2.3	2.3	2.4

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table L

Analysis of Variance and Covariance of
Visual and Aural Stimulus-Sung Response
Ascending Melodic, Descending Melodic, and Harmonic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	44,688.93	1	44,688.93	396.67 **
2. Fall Quarter Experimental Treatment	237.04	2	118.52	1.05
Winter Quarter Fundamentals of Music Section	602.02	3	200.67	1.78
Other Factors	4,913.42	21	233.97	2.08 *
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	4.15	1	4.15	.04
b. (Row)[2]	1,727.62	2	863.81	7.67 **
c. Interaction	151.40	2	75.70	.67
4. Residuals	4,168.42	37	112.66	
5. Total	56,493.00			

6. Means and Differences between Means of Test Scores

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	42.5	51.2	35.8	37.1	38.0	28.9	39.1
Posttest Mean	70.5	66.8	62.7	69.4	60.0	57.1	64.5
Difference	28.0	15.6	26.9	32.3	22.0	28.2	25.4

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	2	5	3	6	4	1
Number of Students	12	11	10	12	11	13
Adjusted Mean	0	4.6	9.5	11.8	14.0	18.7

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 120

[a] 1. Ascending melodic, Aural knowledge of results
2. Descending melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending melodic, Visual knowledge of results
5. Descending melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table LI

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Ascending Melodic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	701.45	1	701.45	88.23 **
2. Fall Quarter Experimental Treatment	3.58	2	1.79	.23
Winter Quarter Fundamentals of Music Section	129.23	3	43.08	5.42 **
Other Factors	450.20	21	21.44	2.70 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	10.11	1	10.11	1.27
b. (Row)[2]	107.62	2	53.81	6.77 **
c. Interaction	6.72	2	3.36	.42
4. Residuals	294.09	37	7.95	
5. Total	1,703.00	69		

6. Means and Differences between Means

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	15.9	16.7	13.3	14.9	13.3	12.8	14.5
Posttest Mean	19.5	17.9	18.3	19.5	16.3	15.0	17.7
Difference	3.6	1.2	5.0	4.6	3.0	2.2	3.2

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	6	2	5	3	4	1
Number of Students	12	12	11	10	11	13
Adjusted Mean	0	.7	.8	1.8	3.6	4.9

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table LII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Descending Melodic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of posttest-pretest differences	753.39	1	753.39	66.03 **
2. Fall Quarter Experimental Treatment	5.02	2	2.51	.22
Winter Quarter Fundamentals of Music Section	58.58	3	19.53	1.71
Other Factors	621.43	21	29.59	2.59 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	7.49	1	7.49	.66
b. (Row)[2]	.53	2	.26	.02
c. Interaction	7.33	2	3.67	.32
4. Residuals	422.23	37	11.41	
5. Total	1,876.00	69		

6. Means and Differences between Means							
Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	12.0	12.3	11.9	13.3	11.6	9.6	11.8
Posttest Mean	15.2	16.9	14.6	16.2	15.0	12.6	15.1
Difference	3.2	4.6	2.7	2.9	3.4	3.0	3.3
7. Differences between Means due to Experimental Treatment of Winter Quarter Groups							
Treatment Group	4	5	3	6	2	1	
Number of Students	11	11	10	12	12	13	
Adjusted Mean	0	.3	.8	1.0	1.1	2.0	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Table LIII

Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Harmonic Interval Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	469.57	1	469.57	44.72 **
2. Fall Quarter Experimental Treatment	5.74	2	2.87	.27
Winter Quarter Fundamentals of Music Section	60.63	3	20.21	1.92
Other Factors	590.60	21	28.12	2.68 **
3. Treatment of Winter Quarter Experimental Groups				
a. (Column)[1]	9.97	1	9.97	.95
b. (Row)[2]	50.48	2	25.24	2.40
c. Interaction	21.49	2	10.74	1.02
4. Residuals	388.52	37	10.50	
5. Total	1,597.00			

6. Means and Differences between Means

Winter Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	13	12	10	11	11	12	69
Pretest Mean[b]	12.0	11.9	9.7	12.6	11.7	7.0	10.8
Posttest Mean	12.8	13.2	15.7	14.2	13.1	12.2	13.4
Difference	.8	1.2	6.0	1.6	1.4	5.2	2.6

7. Differences between Means due to Experimental Treatment of Winter Quarter Groups

Treatment Group	2	3	6	5	4	1
Number of Students	12	10	12	11	11	13
Adjusted Mean	0	2.5	2.9	3.0	3.8	4.2

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 24

[a] 1. Ascending Melodic, Aural knowledge of results
2. Descending Melodic, Aural knowledge of results
3. Harmonic, Aural knowledge of results
4. Ascending Melodic, Visual knowledge of results
5. Descending Melodic, Visual knowledge of results
6. Harmonic, Visual knowledge of results

Discussion

The inferences of these results are:

(1) There were differential effects between ascending, descending, and harmonic interval presentations. Overall use of the ascending melodic interval presentation with voice response appeared to be more effective. It has been observed that music teachers and students spend more time in playing and singing scales and intervals in an ascending fashion. It is conceivable that the ascending melodic presentation and voice response was more realistic to the learning environment of students. In other words, students were already oriented in this general method of presentation more than in the presentation of descending melodic intervals or harmonic intervals.

(2) The learning of descending melodic intervals was a relatively difficult task when compared to either ascending or harmonic intervals. Traditionally it has been assumed that an ordering of difficulty was: (1) ascending, (2) descending, (3) harmonic. There was evidence from this research to support an alternative ordering: (1) ascending, (2) harmonic, (3) descending. An instructional pattern based on this latter order can be helpful to students learning intervals.

(3) Though it is impossible to sing harmonic intervals, students did sing a "harmonic" interval after hearing a harmonic interval played on the piano by first singing up and then returning to the original note. This practice was shown to be an effective instructional method. The response incorporated both the elements of ascending melodic instruction and descending melodic instruction. This investigator believes that such practice can be worthwhile in the instruction of students.

(4) In all of the experiments involving intervals, there was no evidence that there were differential effects from either aural knowledge of results

or visual knowledge of results. The data clearly show that students in both methods made gains, however, there was no data to indicate one knowledge of results method was better than the other. The fact that some students used the extra piece of equipment by which they obtained visual knowledge of results was possibly helpful in their learning. It was possible that the difference in reaction to the two different modes of knowledge of results was an influence of background variables. One student may benefit from a particular method of knowledge of results whereas another student would be aided by an entirely different method. Herein lies an important question for future research.

(5) From this experiment there was some indication that some students need only one method of interval presentation and use this knowledge and skill to perform related tasks. Other students, however, do need training in all interval presentations.

(6) The analyses of the 69 students varied slightly from the total group of 83 students. Though the variance was slight, there was an indication that experimental treatment once again was more effective for the group of students who continued throughout the freshman year. It appears from the second analysis of the interval data that these students who continued through the freshman year were a different group of people than those students who left the music program.

Table LIV

Product-Moment Coefficients of Correlation (r)
between Interval Pretest Scores
Number of Subjects = 69
(coefficients of correlation significant at the 1 per cent level underlined)

	Total Written Responses	Ascending Melodic Written Response	Descending Melodic Written Response	Harmonic Written Response	Total Voice Responses	Ascending Melodic Visual Stimulus Voice Response	Descending Melodic Visual Stimulus Voice Response	Ascending Melodic Aural Stimulus Voice Response	Descending Melodic Aural Stimulus Voice Response	Harmonic Aural Stimulus Voice Response
Total Written Responses		.76	.85	.78	.76	.58	.59	.68	.73	.71
Ascending Melodic Written Response			.71	.68	.76	.60	.57	.73	.74	.63
Descending Melodic Written Response				.79	.79	.60	.61	.70	.77	.77
Harmonic Written Response					.73	.56	.51	.64	.73	.74
Total Voice Responses						.86	.83	.89	.92	.86
Ascending Melodic Visual Stimulus Voice Response							.84	.68	.62	.58
Descending Melodic Visual Stimulus Voice Response								.63	.66	.58
Ascending Melodic Aural Stimulus Voice Response									.83	.73
Descending Melodic Aural Stimulus Voice Response										.83
Mean	91.1	14.5	11.8	10.8	39.1	6.9	6.3	11.5	9.2	5.3
Standard Deviation	21.4	5.2	5.5	5.8	24.7	5.7	4.7	6.3	5.9	5.7

Table LV

Product-Moment Coefficients of Correlation (r) of Selected Background, School of Music Test Scores, and First Quarter Course Grades with Interval Pretest Scores

Number of Subjects = 69

(Coefficients of correlation significant at the 1 per cent level are underlined)

	Total Written Responses	Ascending Melodic Written Response	Descending Melodic Written Response	Harmonic Written Response	Total Voice Responses	Ascending Melodic Visual Stimulus Voice Response	Descending Melodic Visual Stimulus Voice Response	Ascending Melodic Aural Stimulus Voice Response	Descending Melodic Aural Stimulus Voice Response	Harmonic Aural Stimulus Voice Response	Mean	Standard Deviation
Number of years of Private Study	.19	.11	.15	.16	.20	.10	.12	.11	.20	.33	7.0	3.9
Number of years of Piano Study	.20	.12	.16	.34	.21	.23	.11	.11	.15	.31	4.1	4.5
Music Placement Test Battery												
Section I, Aural and Notational Skills	.53	.33	.36	.46	.35	.35	.45	.44	.30	.48	41.3	5.1
Audition	.23	.11	.19	.11	.25	.31	.21	.28	.17	.10	2.9	.9
Diagnostic Test Battery Elements of Music Theory Total Scores												
Notation Speed	.36	.23	.12	.16	.18	.17	.07	.14	.24	.16	52.4	15.1
Notation Accuracy	.33	.36	.24	.18	.15	.19	.08	.15	.20	.06	57.1	16.6
Notation Output	.39	.33	.19	.20	.19	.20	.09	.18	.25	.12	31.1	15.3
Aural Recognition	.49	.43	.48	.70	.49	.36	.46	.71	.47	.32	60.4	14.5
Visual Recognition	.41	.25	.30	.35	.32	.37	.31	.19	.25	.26	49.2	16.6
Mean	91.1	16.5	11.8	10.8	39.1	6.9	6.3	11.5	9.2	5.3		
Standard Deviation	21.4	5.2	5.5	5.8	26.7	5.7	4.7	6.3	3.9	5.7		

Table LVI

Product-Moment Coefficients of Correlation (r)
of Number of Tapes used in Practice
Number of Subjects = 69
(Coefficients of Correlation significant at the 1 per cent level are underlined)

	Total Written Responses	Ascending Melodic Written Response	Descending Melodic Written Response	Harmonic Written Response	Total Voice Responses	Ascending Melodic Visual Stimulus Voice Response	Descending Melodic Visual Stimulus Voice Response	Ascending Melodic Aural Stimulus Voice Response	Descending Melodic Aural Stimulus Voice Response	Harmonic Aural Stimulus Voice Response	Mean	Standard Deviation
Number of times Tape 10 was done	.01	-.15	-.15	.22	-.02	.08	.03	-.09	-.03	-.02	3.9	6.2
Total Number of Tapes done	.17	-.03	.09	-.48	-.01	.01	-.06	-.15	.09	-.12	21.1	13.5
Mean	15.3	3.2	3.3	2.6	25.4	6.6	4.2	5.5	5.4	3.7		
Standard Deviation	11.9	4.0	4.1	4.4	13.2	4.7	4.2	5.2	4.4	4.1		

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PART IV

PHASE I, EXPERIMENT NUMBER 3, TONE GROUPS

Introduction

Experiments 1, rhythm, and 2, intervals, investigated the learning of basic music elements in their simplest form. Music, however, is neither rhythm, nor pitch alone, but a combination of tonal relationships and different rhythmic patterns. When music is discussed even in simple terms, it is commonly understood to include rhythm and pitch. By combining a series of two intervals with a rhythmic pattern, it is possible to form a short unit of music which is defined here as a tone group.

Investigators (Spohn, Poland 1964, p. 18) constructed tone groups for the purpose of investigating the effects of a visual and aural stimulus when compared with a voice or written response. The tone groups used in this study were constructed to cover a common practice range of interval and rhythmic problems.

Past research (Spohn, Poland 1964) indicated the tone groups were difficult to learn. This investigator believed that short patterns of rhythm and pitch were needed which closely corresponded to music which students heard and played. The tone groups used in the past research (Spohn, Poland 1964, Appendix E) were difficult to learn because they were in essence nonsense groups rather than commonly used music groups. Those tone groups, however, made it possible to study the effects of different rhythmic and pitch combinations.

Music has characteristic ascending and descending patterns. In past research tone groups were constructed in only the ascending method. Tone groups were the smallest possible melodic unit. It was possible to determine the effects on learning by adding to a single interval perception the effects of pitch on a particular rhythm and the effects of rhythm on a particular interval. The effect of direction was not investigated. This variable, the effects of direction of tones, was believed by this investigator to have an important part in the learning of a particular combination of intervals and/or rhythm.

Tone groups were composed for this experiment in such a way that there were three different methods, (1) an ascending presentation, (2) a descending presentation, and (3) an ascending and descending pattern. In addition, the question of knowledge of results was of increasing importance, since the learning of more complex tasks might depend upon a particular method of knowledge of results. Perhaps the more complex a task, the more important it would be whether or not students had aural knowledge of results of visual knowledge of results. This study was intended to answer the following questions:

1. Whether the use of an ascending pattern, a descending pattern, or a pattern of ascending and descending tone groups facilitaed the learning of this particular music grouping;

2. Whether one of the methods of presentation was more useful for students than another for learning tone groups;

3. Whether an aural or visual method of providing knowledge of results facilitated the learning of a particular tone group pattern; and

4. Whether one method of knowledge of results (either aural or visual) was more useful than the other in learning a particular pattern of tone group presentation.

METHOD

Subjects

The students used in this study were those students who had participated in the previous two experiments and who were enrolled in the third quarter music fundamentals class. The experimental groups were established in a manner similar to that used in the past research (Spohn, Poland 1964). In college and university programs, it is expected that there will be a certain amount of attrition. Past years have shown the attrition to be a rather constant phenomena in the School of Music. The sample for this third experiment numbered 69 students.

Materials

All tone groups were to be derived from the following interval combinations:

Major three - minor three
minor three - Perfect four
Perfect four - Major three
Major two - Major two
Major two - minor two
minor two - Major two
minor three - Major three
Major three - Perfect four
Perfect four - minor three
Major three - Tritone
Major two - Major three
Tritone - Major two

There were limitations placed on tone groups composition which were:

1. No more than one ledger line was used.
2. No more than one accidental, excluding the starting pitch was used.

When these same tone groups were arranged in a descending manner, there were tone group examples which had two accidentals. When this occurred, the example was altered a half-step up or down (B^b, E^b, G became G, E^b, B^b descending and was changed to read G#, E, B; if there were two sharps the example was lowered one half-step).

The first series of taped-material required the student to write two symbolic responses which identified the two intervals heard.

In the later materials, two intervals were combined with one of four rhythms which had been learned in the rhythm training. In the instructional materials each tonal arrangement appeared once with a rhythmic pattern in the following manner:

One rhythm pattern +
Major three - minor three
minor three - Perfect four
Perfect four - Major three
Major two - Major two
Major two - minor two
minor two - Major two

One rhythm pattern +
minor three - Major three
Major three - Perfect four
Perfect four - minor three
Major three - Tritone
Tritone - Major two
Major two - Major three

For presentation within an exercise, the above items were chosen at random. The same procedure was used for the descending tone groups and the ascending-descending tone groups.

No attention was given to the number of accidentals when tone groups were inverted if only a symbolic rather than notational response was required. When making symbolic responses, students were not concerned with writing the notes but were asked to write only the symbolic interval names. In the later exercises students did write the actual notation for pitches. Tone Groups may be seen in Appendix A of this report.

There was a total of 48 tone groups in each of the three different treatments. Pre and posttests included all of the 48 possibilities within each for the three methods of presentation. Table LVIII shows the correlation between tone group pretest scores of the 69 subjects. Again it may be observed the high degree of similarity between the different test sections.

The training took place in the Music Audio-Visual Training Laboratory with one hour of released time from the music fundamentals class. The treatment groups who were given aural knowledge of results heard the correct identification on the tape and were able to compare their answers with a pre-recorded answer. The treatment groups who were given visual knowledge of results used the Tachitron[3] so they could compare the visual printed notation with their written answers. This piece of equipment is shown in Figure 7.

Procedure

At the end of the first week of the third quarter of the academic year the students were given pretests and assigned to the various treatment groups. The outline of procedures and experimental treatments may be seen in Figure 8.

The procedure for all recorded materials was similar to that used in past research (Spohn, Poland 1964) as well as the procedures used in the previous two experiments. The tone groups were sounded, the students were given time to write their response, they were then able to check their answers with either the aural method or visual method, depending upon the treatment group. The training period extended over six weeks. At the end of the training period, the posttest was given. Examples of the pre-posttest may be seen in Appendix B.

Control Variables

The background control variables are shown in Table LVII. Pretest scores with the selected control variables showing significant correlations are shown in Table LVIII. It can be observed that the pattern of correlations from background information in the three experiments reported have varied. In this instance, the fact that students had had two quarters of freshman music theory has a significant correlation on two of the three test sections and the total of all pretest scores. Correlations significant at the one per cent level exist with the previous Fundamentals of Music instruction and expected finding since the learning of tone groups involved more complex skills.

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[3] cf. Renshaw, Samuel (1954), Manual of Instructions Tachitron the Personal Tachistoscope.

Table LVII

The Background Control Variables for the 69 Students who took part in Experiment 3, Tone Groups

	Mean	Standard Deviation
Background Data		
Sex (coded 0 = male, 1 = female)	.4	.5
Age (as of date of acceptance)	18.1	3.7
Number of years of Private Study	7.0	3.3
Number of years of Piano Study	4.1	4.5
Had music theory training in high school (0 = no, 1 = yes)	.6	.5
School of Music Test Scores		
Ohio State Music Placement Test Battery		
Section I - Form VI, Aural and Notational Skills	41.3	5.1
Section II - Form II A, Music Recognition	36.3	5.7
Section III - Form IV A, General Musical Information	32.8	6.6
Ohio State Diagnostic Music Test Battery Section I - Form II, Elements of Music Theory		
Notational Speed Total	52.4	15.1
Notational Accuracy Total	57.1	16.6
Notational Output (Speed X Accuracy) Total	31.1	15.3
Aural Total	60.4	14.5
Visual Total	49.2	16.4
Entrance Audition (where E = 0, A = 4)	2.9	.6
Ohio State Psychological Examination Total Percentile Score	69.2	22.7
Grades (All grades computed with E = 0, D = 1, C = 2, B = 3, A = 4)		
First Quarter Freshman Music Theory	2.7	1.0
First Quarter Freshman English	2.1	.8
First Quarter Freshman Applied Music	3.1	.9
First Two Quarters Freshman Music Theory	2.7	.9
First Two Quarters Freshman English	2.3	.9
First Two Quarters Freshman Applied Music	3.1	.9

Table LVIII

Product-Moment Coefficients of Correlation (r) of
Selected School of Music Test Scores and Two-Quarter Course Grade Averages
with Tone-Group Pretest Scores
Number of Subjects = 69
(coefficients of correlation significant at the 1 per cent level are underlined)

	Ascending Tone Groups	Descending Tone Groups	Ascending and Descending Tone Groups	Total	Mean	Standard Deviation
Music Placement Test Battery						
Section I, Aural and Notational Skills	.56	.55	.55	.57	41.3	5.1
Diagnostic Test Battery Elements of Music Theory Total Scores						
Aural Recognition	.55	.53	.52	.55	60.4	14.5
Visual Recognition	.32	.29	.29	.31	49.2	16.4
Course Grades						
First Two Quarters of Freshman Music Theory	.26	.35	.36	.34	2.7	0.9
Mean	8.3	10.2	7.0	25.6		
Standard Deviation	9.8	11.8	10.0	30.8		

Table LIX

Product-Moment Coefficients of Correlation (r)
between Tone Group Pretest Scores
Number of Subjects = 69
(coefficients of correlation significant at the 1 per cent level are underlined)

	Ascending Tone Groups	Descending Tone Groups	Ascending and Descending Tone Groups	Total
Ascending Tone Groups		.91	.89	.96
Descending Tone Groups			.94	.98
Ascending and Descending Tone Groups				.97
Mean	8.3	10.2	7.0	25.6
Standard Deviation	9.8	11.8	10.0	30.8

Figure 7.

The Tachitron

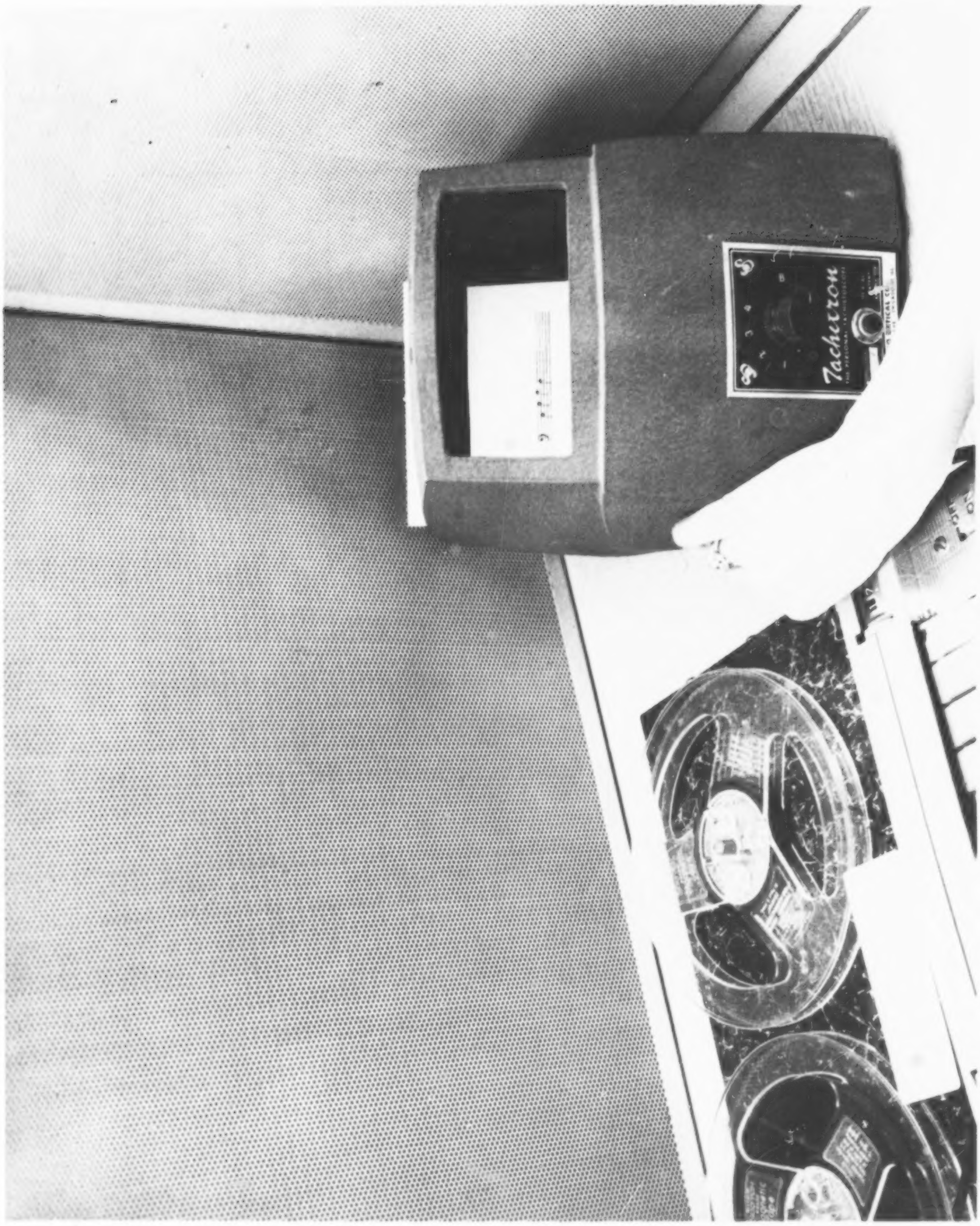

Figure 8.

Procedures and Experimental Treatments for Experiment 3, Tone Groups

Time Per Unit:	Eight Seconds	Ten Seconds	Twelve Seconds
Instructional Procedures:	Stimulus (Tone Group)	Response	Knowledge of Results (An aural or visual identification of the stimulus was given which enabled the student to check his response.)
EXPERIMENTAL TREATMENT	1. The student heard an ascending melodic tone group.	1. The student wrote the tone group in musical notation.	1. The student heard a pre-recorded description of the stimulus. The stimulus was then repeated.
	2. The student heard a descending melodic tone group.	2. The student wrote the tone group in musical notation.	2. The student heard a pre-recorded description of the stimulus. The stimulus was then repeated.
	3. The student heard a tone group which ascended and then descended.	3. The student wrote the tone group in musical notation.	3. The student heard a pre-recorded description of the stimulus. The stimulus was then repeated.
	4. The student heard an ascending melodic tone group.	4. The student wrote the tone group in musical notation.	4. The student saw the tone group in musical notation in the Tachitron.
	5. The student heard a descending melodic tone group.	5. The student wrote the tone group in musical notation.	5. The student saw the tone group in musical notation in the Tachitron.
	6. The student heard a tone group which ascended and then descended.	6. The student wrote the tone group in musical notation.	6. The student saw the tone group in musical notation in the Tachitron.
	Note: The first two tapes in the training required a response of interval symbols only and consequently aural knowledge of results was also the recorded spoken symbol.		

Results

Analysis of the data reported in Tables LX, LXI, LXII, and LXIII indicate improvement significant at the one per cent level for each treatment, number 1, Grand Mean of posttest minus pretest differences. Taken individually, Table LX, the analysis of the data for the ascending tone group test section shows relationships significant at the one per cent level with the winter quarter interval scores and the spring quarter Fundamentals of Music section. Background information significant at the one per cent level is indicated. There were differential effects due to the experimental treatment of ascending melodic presentation. Treatment groups 1 and 4 both received ascending melodic instruction; group 1 with aural knowledge of results and group 4 with visual knowledge of results. Under number 7 of Table LX the ordering shows treatment group 4, visual knowledge of results, to be slightly higher. The difference, however, between 4 and 1 is not significant.

Table LXI, the analysis of data for the descending tone groups on which groups 2 and 5 trained, shows improvement significant at the one per cent level on this task made by all groups. The combined effect of background information, Other Factors, is shown to be significant. Under number 3 it can be observed that, again, differential effects due to the experimental treatment exist in the improvement of the treatment groups on descending tone groups. Groups 2 and 5 who trained on descending tone groups are not significantly different than groups 1 and 4 who trained on ascending melodic tone groups. Treatment groups 4 and 5 trained using visual knowledge of results and rank slightly higher; the difference between adjusted means of groups 1 and 2 is not significant.

In Table LXII it may be observed that data from the ascending-descending tone group portion of the test are shown. The Grand Mean for

Table LX
Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Ascending Tone Group Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	8,239.36	1	8,239.36	223.90 **
2. Fall Quarter Rhythm Scores	36.01	2	18.00	.49
Winter Quarter Interval Scores	638.59	4	159.65	4.34 **
Spring Quarter Fundamentals of Music Section	526.71	3	175.57	4.77 **
Other Factors	2,443.52	21	116.36	3.16 **
3. Treatment of Spring Quarter Experimental Groups				
a. (Column)[1]	3.48	1	3.48	.09
b. (Row)[2]	596.41	2	298.20	8.10 **
c. Interaction	14.55	2	7.28	.20
4. Residuals	1,214.37	33	36.80	
5. Total	13,713.00	69		

6. Means and Differences between Means

Spring Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	11	12	11	11	12	12	69
Pretest Mean[b]	4.00	10.33	6.36	14.09	6.67	8.50	8.33
Posttest Mean	17.91	17.16	16.18	28.91	16.92	18.92	19.26
Difference	13.91	6.83	9.82	14.82	10.25	10.42	10.93

7. Difference between Means due to Experimental Treatment of Spring Quarter Groups

Treatment Group	3	5	6	2	1	4
Number of Students	11	12	12	12	11	11
Adjusted Means	0	1.47	1.64	2.48	10.46	12.16

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 48

[a] 1. Ascending tone groups, Aural knowledge of results
2. Descending tone groups, Aural knowledge of results
3. Ascending and Descending tone groups, Aural knowledge of results
4. Ascending tone groups, Visual knowledge of results
5. Descending tone groups, Visual knowledge of results
6. Ascending and Descending tone groups, Visual knowledge of results

Table LXI
Analysis of Variance and Covariance of
Aural Stimulus-Written Response
Descending Tone Group Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	4,400.01	1	4,400.01	73.14 **
2. Fall Quarter Rhythm Scores	81.52	2	40.76	.68
Winter Quarter Interval Scores	351.09	4	87.77	1.46
Spring Quarter Fundamentals of Music Section	375.22	3	125.07	2.08
Other Factors	3,290.19	21	156.68	2.60 **
3. Treatment of Spring Quarter Experimental Groups				
a. (Column)[1]	18.39	1	18.39	.31
b. (Row)[2]	687.71	2	343.86	5.72 **
c. Interaction	24.75	2	12.38	.21
4. Residuals	1,985.12	33	60.16	
5. Total	11,214.00			

6. Means and Differences between Means

Spring Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	11	12	11	11	12	12	69
Pretest Mean[b]	8.55	11.50	9.64	15.91	6.17	9.58	10.17
Posttest Mean	15.73	18.42	15.46	24.73	20.42	14.33	18.16
Difference	7.18	6.92	5.82	8.82	14.25	4.75	7.99

7. Difference between Means due to Experimental Treatment of Spring Quarter Groups

Treatment Group	6	3	2	1	5	4
Number of Students	12	11	12	11	12	11
Adjusted Means	0	.91	7.27	8.95	9.71	11.03

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 48

[a] 1. Ascending tone groups, Aural knowledge of results
2. Descending tone groups, Aural knowledge of results
3. Ascending and Descending tone groups, Aural knowledge of results
4. Ascending tone groups, Visual knowledge of results
5. Descending tone groups, Visual knowledge of results
6. Ascending and Descending tone groups, Visual knowledge of results

Table LXII
Analysis of Variance and Covariance of Aural Stimulus-Written Response Ascending and Descending Tone Group Presentation Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	2,159.36	1	2,159.36	63.23 **
2. Fall Quarter Rhythm Scores	52.75	2	26.38	.77
Winter Quarter Interval Scores	561.67	4	140.42	4.11 **
Spring Quarter Fundamentals of Music Section	256.19	3	85.40	2.50
Other Factors	1,762.17	21	83.91	2.46 *
3. Treatment of Spring Quarter Experimental Groups				
a. (Column)[1]	53.72	1	53.72	1.57
b. (Row)[2]	81.64	2	40.82	1.20
c. Interaction	39.42	2	19.71	.58
4. Residuals	1,127.08	33	34.15	
5. Total	6,094.00			

6. Means and Differences Between Means

Spring Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	11	12	11	11	12	12	69
Pretest Mean[b]	5.36	7.17	5.91	12.64	4.42	7.00	7.04
Posttest Mean	9.09	10.92	11.37	18.55	10.42	15.58	12.63
Differences	3.73	3.75	5.46	5.91	6.00	8.58	5.59

7. Differences between Means due to Experimental Treatment of Spring Quarter Groups

Treatment Group	3	2	5	1	6	4
Number of Students	11	12	12	11	12	11
Adjusted Means	0	1.46	2.00	4.60	5.10	6.53

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 48

[a]
1. Ascending tone groups, Aural knowledge of results
2. Descending tone groups, Aural knowledge of results
3. Ascending and Descending tone groups, Aural knowledge of results
4. Ascending tone groups, Visual knowledge of results
5. Descending tone groups, Visual knowledge of results
6. Ascending and Descending tone groups, Visual knowledge of results

Table LXIII
Analysis of Variance and Covariance of Aural Stimulus-Written Response
Ascending, Descending, and Ascending-Descending Tone Group Presentation
Scores of 69 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	41,441.75	1	41,441.75	131.48 **
2. Fall Quarter Rhythm Score	343.80	2	171.90	.55
Winter Quarter Interval Scores	4,162.95	4	1,040.74	3.30 *
Spring Quarter Fundamentals of Music Section	3,506.12	3	1,168.71	3.71 *
Other Factors	19,075.73	21	908.37	2.88 **
3. Treatment of Spring Quarter Experimental Groups				
a. (Column)[1]	221.11	1	221.11	.70
b. (Row)[2]	2,797.43	2	1,398.72	4.44 *
c. Interaction	30.38	2	15.19	.05
4. Residuals	10,401.73	33	315.20	
5. Total	81,981.00	69		

6. Means and Differences between Means

Spring Quarter Treatment Group[a]	1	2	3	4	5	6	Total
Number of Students	11	12	11	11	12	12	69
Pretest Mean[b]	17.91	29.00	21.91	42.64	17.25	25.08	25.55
Posttest Mean	42.73	46.50	43.00	72.19	47.75	48.83	50.06
Differences	24.82	17.50	21.09	29.55	30.50	23.75	24.51

7. Differences between Means due to Experimental Treatment of Spring Quarter Groups

Treatment Group	3	6	2	5	1	4
Number of Students	11	12	12	12	11	11
Adjusted Means	0	6.18	10.41	12.57	23.64	29.14

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 144

[a] 1. Ascending tone groups, Aural knowledge of results
2. Descending tone groups, Aural knowledge of results
3. Ascending and Descending tone groups, Aural knowledge of results
4. Ascending tone groups, Visual knowledge of results
5. Descending tone groups, Visual knowledge of results
6. Ascending and Descending tone groups, Visual knowledge of results

Table LXIV

Product-Moment Coefficients of Correlation (r)
Between Time Spent in Experimental Tone Group Treatment and
Tone Group Posttest-Pretest Difference Scores
Number of Subjects = 69
(coefficients of correlation significant at the 1 per cent level are underlined)

	Posttest minus Pretest Ascending Tone Groups	Posttest minus Pretest Descending Tone Groups	Posttest minus Pretest Ascending and Descending Tone Groups	Posttest minus Pretest Total Scores on Tone Groups	Mean	Standard Deviation
Number of Tape 10 Practices	-.32	-.16	-.16	-.24	4.0	3.7
Total Number of Tape Practices	-.14	-.06	-.02	-.04	26.5	18.3
Mean	10.9	8.0	5.6	24.5		
Standard Deviation	9.9	10.3	7.7	25.3		

overall improvement of the treatment groups is significant at the one per cent level. Winter quarter interval scores are again shown to be significant at the one per cent level. Background (under Other Factors) is shown to be significant at the five per cent level. There is no differential effect shown for any experimental treatment. Groups 3 and 6 were trained on this task; significant improvement was made in the task. Under number 7, it appears that all groups with the adjusted means are not significantly different on this task.

Table LXIII shows the analysis of total scores made by all treatment groups on all tone groups. Overall, it may be said that significant improvement was made by all groups. Winter quarter interval scores were significant in the improvement on this task. Spring quarter Fundamentals of Music section was also significant at the five per cent level. Background information (under Other Factors) again was significant at the five per cent level. There was no evidence that aural or visual knowledge of results was significant as part of the experimental treatment. There was however, evidence that either ascending or descending presentation of tone groups was significant at the five per cent level in the learning of tone groups.

Discussion

The inferences of this study are:

(1) there was evidence that the organization of pitches by direction was helpful in learning to perceive tone groups. Either direction, ascending or descending, appeared to be more effective than tone group presentation with a change of direction within the group, the ascending-descending task. This information indicated that materials which tended to be directional were easier for the students to learn. Changes of direction tended to confound or confuse student learning of tone groups.

(2) There was no evidence that either aural knowledge of results or visual knowledge of results was more effective than the other for providing information to the students. There was some indication, though not significant, that viewing the material assisted some people. Perhaps differences in learning by either aural or visual knowledge of results methods was not a contributing factor on a group basis but was for an individual.

(3) This report was the first statistical evidence to indicate a relationship between the task of identifying intervals and the more complex task of identifying interval relationships within short melodic groups. Since only one rhythm for each tone group presented was involved, the rhythmic problem still remained a somewhat simple task for the students. It was evident from the data, however, that the task of learning a series of pitches was a cumulative one.

Research needs to be undertaken which will determine the difficulty when each additional interval, pitch, and rhythm are added to tone groups. The related difficulty of each addition would be valuable information in developing materials for learning music.

PART V

PHASE II, EXPERIMENT NUMBER 4, MELODIES

Introduction

Experiments 1, 2, and 3, reported in this study, were Phase I of an extended study. Experiment 4, which investigated the learning of music in longer and more complex units, was Phase II. Phase I gave an opportunity for experimental study and provided needed instruction which enabled students to acquire proficiency in their ability to perceive rhythms, intervals, and tone groups. On inspection, the reader can observe that data reported in Experiments 1, 2, and 3 revealed that the students who had gone through the previous three experiments showed improvement in their ability to identify rhythms, intervals, and tone groups. This improvement was supported by statistical analysis.

One important question in music as well as other areas of learning involves the psychological principles of meaningfulness and grouping. The question is: "Do people learn to perceive longer segments of music (music phrases) by (1) a meaningful unit presentation, (2) drills devised from rhythmic and various tonal elements found in music, or (3) progressing from smaller to larger units as suggested by visual perception research?" Renshaw (1954) improved reading skills by tatistoscopic techniques and the extended grouping of digits. Such a technique adapted to music might improve learning.

Since there previously had not been a way of providing training so that each individual task could be learned, evaluated, and adequately placed in a sequence until present methodology, it had been difficult to investigate this more complex phase of music learning. Tone groups developed and used in past research (Spohn, Poland 1964 and Experiment Number 3 of this report) provide a basis for investigating this problem. The unique facilities and methods developed and used for learning music at The Ohio State University School of Music Audio-Visual Training Laboratory made this study possible.

Teacher education literature in music has been directed toward "whole learning" initiated by the Gestalt school of psychology as the approach to music learning; the Renshaw instruction program in reading has been cited as another possible position for the organization of music materials. Common practice in music instruction which involves the practice and learning of problems the student must face in music or will exist in music at some future date has been challenged by teachers who have been guided by either Gestalt psychology or an approach similar to Renshaws. None of the basic positions for music learning have been compared with the others in a practical situation. There were three clearly established basic organizational patterns for learning of music. They were:

a. traditionally meaningful or contextual units;

b. large non-contextual units developed to present problems of progressive difficulty found in actual music;

c. small units (tone groups) progressively expanded into larger spacial and temporal units.

This study is intended to answer questions about the material organization for learning music as follows:

(1) whether the use of contextual units, large non-contextual units, or small units of music (tone groups) progressively expanded into longer and more complex units facilitated music learning;

(2) whether one of the above organizational patterns was overall more effective for the student than the other in learning music;

Table LXV

Product-Moment Coefficients of Correlation (r)
between Melodic Group Pretest Scores
Number of Subjects = 48
(coefficients of correlation significant at the 1 per cent level are underlined)

	Correct Number of Meter	Correct Number of Rhythm	Correct Number of Octaves	Correct Number of Pitches	Total Number of Correct Examples	Examples with Correct Rhythms	Examples with Correct Pitches	Number of Correct Training Melodies
Correct Number of Meter		.71	.16	.35	.57	.60	.44	.62
Correct Number of Rhythm			.27	.68	.68	.74	.68	.63
Correct Number of Octaves				.39	.17	.18	.19	.22
Correct Number of Pitches					.76	.61	.90	.66
Total Number of Correct Examples						.81	.91	.90
Examples with Correct Rhythms							.71	.74
Examples with Correct Pitches								.78
Number of Correct Training Melodies								
Mean	6.2	81.1	10.0	70.5	1.1	2.2	1.8	0.8
Standard Deviation	3.0	34.2	1.3	34.3	1.4	1.9	2.0	0.8

Table LXVI

The Background Control Variables for the 48 Students who took part in Experiment 4, Melodies

	Mean	Standard Deviation
Background Data		
Sex (coded 0 = male, 1 = female)	.3	.5
Age (as of date of acceptance)	18.3	4.5
Number of years of Private Study	6.8	3.2
Number of years of Piano Study	4.2	4.4
Had music theory training in high school (0 = no, 1 = yes)	.6	.5
School of Music Test Scores		
Ohio State Music Placement Test Battery		
Section I - Form VI, Aural and Notational Skills	42.2	4.8
Section II - Form II A, Music Recognition	37.0	5.9
Section III - Form IV A, General Musical Information	33.5	6.6
Ohio State Diagnostic Music Test Battery Section I - Form II, Elements of Music Theory		
Notational Speed Total	52.4	15.7
Notational Accuracy Total	58.8	17.0
Notational Output (Speed X Accuracy) Total	32.0	16.0
Aural Total	62.5	14.7
Visual Total	50.8	16.1
Entrance Audition (where E = 0, A = 4)	3.1	.8
Ohio State Psychological Examination Total Percentile Score	69.1	22.6
Grades (All grades computed with E = 0, D = 1, C = 2, B = 3, A = 4)		
Three Quarters Freshman Music Theory	2.8	.8
Three Quarters Freshman English	2.1	.7
Three Quarters Freshman Applied Music	3.1	.7

5

Table LXVII

Product-Moment Coefficients of Correlation (r) of
Selected School of Music Test Scores and Three-Quarter Course Grade Averages
with Melodic Group Pretest Scores
Number of Subjects = 48
(coefficients of correlation significant at the 1 per cent level are underlined)

	Correct Number of Meter	Correct Number of Rhythm	Correct Number of Octaves	Correct Number of Pitches	Total Number of Correct Examples	Examples with Correct Rhythms	Examples with Correct Pitches	Number of Correct Training Melodies	Mean	Standard Deviation
Music Placement Test Battery										
Section I, Aural and Notational Skills	.18	.40	.28	.57	.51	.48	.56	.52	42.2	4.8
Diagnostic Test Battery Elements of Music Theory Total Scores										
Notation Speed	.44	.51	.29	.38	.39	.39	.36	.33	52.4	15.7
Notation Output	.38	.40	.23	.35	.40	.39	.34	.38	32.0	16.0
Aural Recognition	.21	.47	.42	.68	.50	.39	.60	.39	62.5	14.7
Visual Recognition	.19	.25	.35	.17	.44	.30	.30	.43	50.8	16.1
Course Grades										
Three Quarters of Freshman Music Theory	.16	.29	.25	.46	.42	.30	.51	.37	2.8	.8
Three Quarters of Private Study	.35	.42	.26	.44	.34	.23	.36	.38	3.1	.7
Mean	6.2	81.1	10.0	70.5	1.1	2.2	1.8	.8		
Standard Deviation	3.0	34.2	1.3	34.5	1.4	1.9	2.0	.8		

(3) whether aural or visual knowledge of results facilitated learning one of the above material organizational patterns; and

(4) whether aural or visual knowledge of results was more useful for one or another in learning a particular organizational pattern of music.

METHOD

Subjects

The subjects were those students who had returned as sophomores in the School of Music in the Fall of 1965 for their second academic year. They were enrolled in the sophomore music sightsinging and harmony class and remained in these classes through the first two quarters of instruction.

Materials

The materials used in this portion of the study were determined after consultation with the chairman of the Music Theory Department. Actual classroom materials (music melodies) were selected to be analyzed and used in three different ways. The first group of materials was the actual melodies selected from the sophomore classroom materials. The second group of materials was a series of rhythm drills followed by pitch drills which were extracted from the melodies selected for the study. The third group of materials were tone groups similar to those used in Experiment Number 3 but extracted from the above sophomore melodies. Each of the tone groups was expanded into longer groups until the melody was complete.

All materials were recorded on tape in a manner similar to that used in the previous research. The stimulus portion was sounded on the piano, time was allowed for the student to respond, and then the student checked his written answer by means of aural or visual knowledge of results. The training took place in the Music Audio-Visual Training Laboratory. All instruction in the laboratory was in addition to regular classroom instruction and on the students own time. No released time was allowed.

The laboratory instruction was additional homework. The equipment used in the previous experiment was available for this portion of the study. The students who were given aural knowledge of results needed only the tape recorder, work sheets, and tapes; answers for the aural knowledge of results had been previously recorded on the tapes. The students in the visual knowledge of results portion of this study used the Tachitron which was also used in Experiment Number 3 of this study. These students were able to see the printed notation.

The object of the training was to develop the ability to notate complete melodies. A pre-posttest was constructed to evaluate the starting level and training. Six melodies were selected on which the students were trained and these melodies were included as part of the test. An additional six melodies were selected as part of the test; on which there was no training.

The tests were graded on the following: correct number of meter, correct number of rhythm, correct octave, correct number of pitches, total number of correct melodies, total number of examples with correct rhythm, total number of examples with correct pitches, total number of correct training melodies. Each error was counted as 1. The tables in the result section show the total number of possible errors. Table LXV shows the correlation between the several melodic group pretest scores. The significant correlations followed a logical and expected pattern. For instance, the correlation of .71, correct number of meter with the correct number of rhythm, K2 would be expected since correct meter was necessary to determine rhythms.

Procedure

During the second week of the 1964 Fall quarter, students were assigned to the six treatment groups. The outline of procedures and experimental treatments may be seen in Figure 9.

Figure 9.

Procedures and Experimental Treatments for Experiment 4, Melodies

Time Per Unit	Five to Twelve Seconds[1]	Five to Twelve Seconds[1]	Twelve to Twenty Seconds[1]
Instructional Procedures:	Stimulus (Melody)	Response	Knowledge of Results (An aural or visual identification of the stimulus was given which enabled the student to check his response.)
EXPERIMENTAL TREATMENTS	1. The student heard a complete melody played three times.	1. The student wrote the melody (pitch and rhythm) in musical notation.	1. The student heard a pre-recorded answer which described the stimulus in words; then the stimulus was repeated.
	2. The student heard a rhythmic drill twice. The student heard a series of pitches from the above melodies.	2. The student wrote the rhythmic drill in musical notation. The student wrote the melodic (and rhythmic) drill in musical notation.	2. The student heard a pre-recorded answer which described the stimulus in words after the rhythmic drill and after the melodic drill stimuli. After each description, the stimulus was repeated.
	3. The student heard the first part of the melody played twice. The student heard the second part of the melody played twice.	3. The student wrote the first part of the melody in musical notation. The student wrote the second part of the melody in musical notation.	3. The student heard a pre-recorded answer which described the stimulus in words after the first and after the second part of the melody. After each description, the stimulus was repeated.
	4. The student heard a complete melody played three times.	4. The student wrote the melody (pitch and rhythm) in musical notation.	4. The student saw the stimulus in musical notation in the Tachitron.
	5. The student heard a rhythmic drill twice. The student heard a series of pitches from the above melodies.	5. The student wrote the rhythmic drill in musical notation. The student wrote the melodic (and rhythmic) drill in musical notation.	5. The student saw the rhythmic and melodic drills in musical notation in the Tachitron.
	6. The student heard the first part of the melody played twice. The student heard the second part of the melody played twice.	6. The student wrote the first part of the melody in musical notation. The student wrote the second part of the melody in musical notation.	6. The student saw the two parts of the melody in musical notation in the Tachitron.
	NOTE: A chord was played before each stimulus to orient the student in the tonality. The stimulus was accompanied by metronomic ticks for rhythmic orientation. The student was always given time for his response equivalent to the time unit of the stimulus.	[1] The time per unit varied with each stimulus and knowledge of results unit due to the length and difficulty of successive stimuli increased with each succeeding drill. The time per unit of knowledge of results likewise varied according to the length of the stimulus and the time needed to describe it.	

Control Variables

Since attrition was known to be a problem in longitudinal studies, it was feared that the smaller number of sophomores would provide inadequate data or, in fact, the characteristics of the sample including the control variables, would change significantly. These control variables with means and standard deviations are presented in Table LXVI for the 48 students who stayed the two academic years. Correlations of background variables and pretest scores may be seen in Table LXVII. This information does not suggest that the population characteristics changed greatly. For more precise measures, the grades received in the first three quarters of the freshman Fundamentals of Music and the first three quarters of freshman English, as well as the grades for the first three quarters of their freshman private music study are included.

Results

Students were given a pretest and began training following the established procedures in the Music Audio-Visual Training Laboratory. The training period covered eight weeks. Posttests were given at the beginning of the second academic quarter. An analysis of variance and covariance was undertaken on each of the test scores for the six treatment groups. These analyses are shown in Tables LXVIII through LXXV.

Since each table was concerned with a specific music learning problem, each was considered separately in this report. Table LXVIII shows the analysis variance of the six groups for correct number of meter scores. Under number 1, Grand Mean, it may be seen that there was overall improvement for groups on this task significant at the one per cent level. Under number 2, the Spring tone group experimental scores were significant at the five per cent level. There was no evidence that there were differential effects from any experimental treatment. Table LXIX shows an analysis

Table LXVIII
Analysis of Variance and Covariance of Melodies
Aural Stimulus-Written Response
Correct Number of Meter
Scores of 48 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	105.02	1	105.02	18.52 **
2. Fall 1963 Scores	6.07	1	6.07	1.07
Winter 1964 Scores	9.18	2	4.59	.81
Spring 1964 Scores	28.46	1	28.46	5.02 *
517 Class	10.06	4	2.52	.44
Other Factors	161.98	20	8.10	1.43
3. Experimental Treatment				
a. (Column)[1]	3.33	1	3.33	59
b. (Row)[2]	12.97	2	6.48	1.14
c. Interaction	10.55	2	5.28	.93
4. Residuals	79.38	14	5.67	
5. Total	427.00	48		

6. Means and Differences between Means

Fall 1964 Treatment[a]	1	2	3	4	5	6	Total
Number	8	11	9	7	5	8	48
Pretest Mean[b]	7.1	6.2	7.0	6.0	4.2	6.1	6.2
Posttest Mean	8.1	8.1	7.8	7.4	6.2	8.0	7.7
Difference	1.0	1.9	.8	1.4	2.0	1.9	1.5

7. Differences between Means due to Experimental Treatment

Treatment	5	2	3	4	6	1
Number	5	11	9	7	8	8
Difference	0	2.2	2.4	3.1	3.5	4.2

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 12

[a] 1. Complete melodies, Aural knowledge of results
2. Rhythmic and melodic drills, Aural knowledge of results
3. Part and expanded groups, Aural knowledge of results
4. Complete melodies, Visual knowledge of results
5. Rhythmic and melodic drills, Visual knowledge of results
6. Part and expanded groups, Visual knowledge of results

Table LXIX

Analysis of Variance and Covariance of Melodies
Aural Stimulus-Written Response
Correct Number of Rhythm
Scores of 48 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	38,703.52	1	38,703.52	43.44 **
2. Fall 1963 Scores	51.11	1	51.11	.06
Winter 1964 Scores	4,072.29	2	2,036.14	2.29
Spring 1964 Scores	311.30	1	311.30	.35
517 Class	3,336.95	4	834.24	.94
Other Factors	20,734.84	20	1,036.74	1.16
3. Experimental Treatment				
a. (Column)[1]	353.85	1	353.85	.40
b. (Row)[2]	2,619.20	2	1,309.60	1.47
c. Interaction	1,000.36	2	500.18	.56
4. Residuals	12,474.58	14	891.04	
5. Total	83,658.00			

6. Means and Differences between Means							
Fall 1964 Treatment[a]	1	2	3	4	5	6	Total
Number	8	11	9	7	5	8	48
Pretest Mean[b]	84.0	88.1	83.0	75.0	48.4	92.0	81.1
Posttest Mean	115.4	113.7	106.7	114.1	78.6	116.1	109.5
Difference	31.4	25.6	23.7	39.1	30.2	24.1	28.4
7. Differences between Means due to Experimental Treatment							
Treatment	5	2	6	3	1	4	
Number	5	11	8	9	8	7	
Difference	0	29.4	42.6	45.9	49.7	52.0	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 176

[a] 1. Complete melodies, Aural knowledge of results
2. Rhythmic and melodic drills, Aural knowledge of results
3. Part and expanded groups, Aural knowledge of results
4. Complete melodies, Visual knowledge of results
5. Rhythmic and melodic drills, Visual knowledge of results
6. Part and expanded groups, Visual knowledge of results

Table LXX

Analysis of Variance and Covariance of Melodies
Aural Stimulus-Written Response
Correct Number of Octaves
Scores of 48 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	2.52	1	2.52	2.57
2. Fall 1963 Scores	.03	1	.03	.03
Winter 1964 Scores	2.58	2	1.29	1.32
Spring 1964 Scores	.07	1	.07	.07
517 Class	2.09	4	.52	.53
Other Factors	79.98	20	4.00	4.08 **
3. Experimental Treatment				
a. (Column)[1]	8.76	1	8.76	8.94 **
b. (Row)[2]	3.84	2	1.92	1.96
c. Interaction	.42	2	.21	.22
4. Residuals	13.71	14	.98	
5. Total	114.00			

6. Means and Differences between Means							
Fall 1964 Treatment[a]	1	2	3	4	5	6	Total
Number	8	11	9	7	5	8	48
Pretest Mean[b]	9.8	10.5	10.1	10.0	9.6	9.5	10.0
Posttest Mean	10.7	10.6	10.0	9.7	9.6	10.3	10.2
Difference	.9	.1	-.1	-.3	.0	.8	.2
7. Differences between Means due to Experimental Treatment							
Treatment	5	6	4	2	1	3	
Number	5	8	7	11	8	9	
Difference	0	.7	1.0	1.2	2.3	2.5	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 12

[a] 1. Complete melodies, Aural knowledge of results
2. Rhythmic and melodic drills, Aural knowledge of results
3. Part and expanded groups, Aural knowledge of results
4. Complete melodies, Visual knowledge of results
5. Rhythmic and melodic drills, Visual knowledge of results
6. Part and expanded groups, Visual knowledge of results

Table LXXI

Analysis of Variance and Covariance of Melodies
Aural Stimulus-Written Response
Correct Number of Pitches
Scores of 48 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	32,708.52	1	32,708.52	103.65 **
2. Fall 1963 Scores	58.58	1	58.58	.19
Winter 1964 Scores	2,738.57	2	1,369.28	4.34 *
Spring 1964 Scores	67.86	1	67.86	.22
517 Class	3,060.69	4	765.17	2.42
Other Factors	19,250.25	20	962.51	3.05 *
3. Experimental Treatment				
a. (Column)[1]	14.05	1	14.05	.04
b. (Row)[2]	1,837.85	2	918.92	2.91
c. Interaction	580.58	2	290.29	.92
4. Residuals	4,418.05	14	315.58	
5. Total	64,735.00			

6. Means and Differences between Means

Fall 1964 Treatment[a]	1	2	3	4	5	6	Total
Number	8	11	9	7	5	8	48
Pretest Mean[b]	53.8	77.8	71.9	71.4	59.2	81.6	70.5
Posttest Mean	81.7	102.4	89.7	109.0	89.4	104.7	96.6
Difference	27.9	24.6	17.8	37.6	30.2	23.1	26.1

7. Differences between Means due to Experimental Treatment

Treatment	5	3	2	6	1	4
Number	5	9	11	8	8	7
Difference	0	14.0	14.2	24.2	36.2	37.4

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 176

[a] 1. Complete melodies, Aural knowledge of results
2. Rhythmic and melodic drills, Aural knowledge of results
3. Part and expanded groups, Aural knowledge of results
4. Complete melodies, Visual knowledge of results
5. Rhythmic and melodic drills, Visual knowledge of results
6. Part and expanded groups, Visual knowledge of results

of the six treatment groups scores on correct number of rhythms. The Grand Mean shown in this table indicated overall improvement on this task by all groups was significant at the one per cent level.

Table LXX shows the analysis for the correct octave indicated a pattern different than any of the analyses presented in this report. No significant improvement was shown under Grand Mean. Other Factors, background information, were significant at the one per cent level. In the experimental treatment there was evidence to support the method of knowledge of results was important in the identification of an octave. In number 7 in Table LXX, it can be seen that groups 1 and 3, both received aural knowledge of results, were shown to be improved and different at the five per cent significant level from the other groups on this task.

Table LXXI is the analysis for the correct number of pitches for all six groups. Overall improvement in the ability of all groups to identify correct pitches was significant at the one per cent level. Scores from Experiment Number 2 were shown to be significant at the five per cent level for this task; background factors were also shown to be significant at the five per cent level. There were no significant differential effects reported for the six experimental treatments.

Table LXXII, the analysis for all groups for twelve melodies which included both those melodies on which students trained as well as the six additional melodies on which they were only tested, the only score reported at the one per cent level of significance was the Grand Mean Posttest-Pretest difference which indicated overall improvement. The difference between pre and posttest means which may be observed under number 6 was significant at the one per cent level.

Table LXXIII, the analysis of the total number of examples with correct pitches also showed the difference between pretest-posttest means

Table LXXII

Analysis of Variance and Covariance of Melodies
Aural Stimulus-Written Response
Total Number of Examples with Correct Rhythm
Scores of 48 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	341.33	1	341.33	96.15 **
2. Fall 1963 Scores	5.11	1	5.11	1.44
Winter 1964 Scores	17.81	2	8.90	2.51
Spring 1964 Scores	7.99	1	7.99	2.25
517 Class	28.66	4	7.16	2.02
Other Factors	96.66	20	4.83	1.36
3. Experimental Treatment				
a. (Column)[1]	.99	1	.99	.28
b. (Row)[2]	24.81	2	12.40	3.49
c. Interaction	7.90	2	3.95	1.11
4. Residuals	49.74	14	3.55	
5. Total	581.00			

6. Means and Differences between Means							
Fall 1964 Treatment[a]	1	2	3	4	5	6	Total
Number	8	11	9	7	5	8	48
Pretest Mean[b]	2.0	2.5	3.3	1.4	.4	2.8	2.2
Posttest Mean	5.1	4.6	4.3	5.8	3.2	6.0	4.9
Difference	3.1	2.1	1.0	4.4	2.8	3.2	2.7
7. Differences between means due to Experimental Treatment							
Treatment	5	2	3	1	6	4	
Number	5	11	9	8	8	7	
Difference	0	1.2	2.4	3.6	3.8	4.6	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 96

[a] 1. Complete melodies, Aural knowledge of results
2. Rhythmic and melodic drills, Aural knowledge of results
3. Part and expanded groups, Aural knowledge of results
4. Complete melodies, Visual knowledge of results
5. Rhythmic and melodic drills, Visual knowledge of results
6. Part and expanded groups, Visual knowledge of results

Table LXXI[illegible]I

Analysis of Variance and Covariance of Melodies
Aural Stimulus-Written Response
Total Number of Examples with Correct Pitches
Scores of 48 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	120.33	1	120.33	39.84 **
2. Fall 1963 Scores	1.66	1	1.66	.55
Winter 1964 Scores	21.47	2	10.73	3.56
Spring 1964 Scores	2.11	1	2.11	.70
517 Class	37.76	4	9.44	3.13 *
Other Factors	74.40	20	3.72	1.23
3. Experimental Treatment				
a. (Column)[1]	.06	1	.06	.02
b. (Row)[2]	7.00	2	3.50	1.16
c. Interaction	9.99	2	5.00	1.66
4. Residuals	42.22	14	3.02	
5. Total	317.00			

6. Means and Differences between Means							
Fall 1964 Treatment[a]	1	2	3	4	5	6	Total
Number	8	11	9	7	5	8	48
Pretest Mean[b]	.9	1.9	2.1	1.7	.8	3.0	1.8
Posttest Mean	2.0	3.6	3.3	4.1	1.6	5.0	3.4
Difference	1.1	1.7	1.2	2.4	.8	2.0	1.6
7. Differences between Means due to Experimental Treatment							
Treatment	5	2	3	1	4	6	
Number	5	11	9	8	7	8	
Difference	0	1.5	1.6	2.4	3.0	3.3	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 96

[a] 1. Complete melodies, Aural knowledge of results
2. Rhythmic and melodic drills, Aural knowledge of results
3. Part and expanded groups, Aural knowledge of results
4. Complete melodies, Visual knowledge of results
5. Rhythmic and melodic drills, Visual knowledge of results
6. Part and expanded groups, Visual knowledge of results

Table LXXIV

Analysis of Variance and Covariance of Melodies
Aural Stimulus-Written Response
Total Number of Correct Examples
Scores Of 48 Subjects in Six Groups Of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	96.33	1	96.33	35.68 **
2. Fall 1963 Scores	11.77	1	11.77	4.36
Winter 1964 Scores	16.62	2	8.31	3.08
Spring 1964 Scores	12.15	1	12.15	4.50
517 Class	30.20	4	7.55	2.79
Other Factors	56.46	20	2.82	1.04
3. Experimental Treatment				
a. (Column)[1]	<.01	1	<.01	<.01
b. (Row)[2]	15.02	2	7.51	2.78
c. Interaction	8.59	2	4.30	1.59
4. Residuals	37.86	14	2.70	
5. Total	285.00			

6. Means and Differences between Means							
Fall 1964 Treatment[a]	1	2	3	4	5	6	Total
Number	8	11	9	7	5	8	48
Pretest Mean[b]	.6	1.1	1.6	1.0	.2	1.9	1.1
Posttest Mean	1.6	2.4	2.6	3.3	.8	4.1	2.5
Difference	1.0	1.3	1.0	2.3	.6	2.2	1.4
7. Differences between Means due to Experimental Treatment							
Treatment	5	2	3	1	6	4	
Number	5	11	9	8	8	7	
Difference	0	1.7	2.6	3.1	3.6	4.1	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 12

[a] 1. Complete melodies, Aural knowledge of results
2. Rhythmic and melodic drills, Aural knowledge of results
3. Part and expanded groups, Aural knowledge of results
4. Complete melodies, Visual knowledge of results
5. Rhythmic and melodic drills, Visual knowledge of results
6. Part and expanded groups, Visual knowledge of results

Table LXXV

Analysis of Variance and Covariance of Melodies
Aural Stimulus-Written Response
Total Number of Correct Training Melodies
Scores of 48 Subjects in Six Groups of Various Sizes
(F Significant at the 5 per cent level indicated by *, 1 per cent by **)

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
1. Grand Mean of Posttest-Pretest Differences	18.75	1	18.75	42.61 **
2. Fall 1963 Scores	2.51	1	2.51	5.70 *
Winter 1964 Scores	3.60	2	1.80	4.09 *
Spring 1964 Scores	2.90	1	2.90	6.58 *
517 Class	5.75	4	1.44	3.26 *
Other Factors	22.09	20	1.10	2.51 *
3. Experimental Treatment				
a. (Column)[1]	.60	1	.60	1.36
b. (Row)[2]	2.82	2	1.41	3.20
c. Interaction	.81	2	.40	.91
4. Residuals	6.17	14	.44	
5. Total	66.00			

6. Means and Differences between Means							
Fall 1964 Treatment[a]	1	2	3	4	5	6	Total
Number	8	11	9	7	5	8	48
Pretest Mean[b]	.5	1.0	1.1	.7	.2	1.1	.8
Posttest Mean	1.1	1.5	1.4	1.6	.8	2.0	1.4
Difference	.6	.5	.3	.9	.6	.9	.6
7. Differences between Means due to Experimental Treatment							
Treatment	5	2	3	6	4	1	
Number	5	11	9	8	7	8	
Difference	0	.8	.9	1.1	1.4	1.7	

Adjusted Means which are not underlined or connected by the same line are significantly different at the 5 per cent level.

---

[1] cf. Figure 1

[2] cf. Figure 1

[b] Total possible score 6

[a] 1. Complete melodies, Aural knowledge of results
2. Rhythmic and melodic drills, Aural knowledge of results
3. Part and expanded groups, Aural knowledge of results
4. Complete melodies, Visual knowledge of results
5. Rhythmic and melodic drills, Visual knowledge of results
6. Part and expanded groups, Visual knowledge of results

to be significant at the one per cent level. Class instruction received during the quarter was indicated as significant at the five per cent level.

Table LXXIV, the analysis of the total number of correct examples for all groups, indicated the differences under number 6 between pretest and posttest means to be significant at the one per cent level. It can be observed, however, that no other significant differences were shown.

Table LXXV showed the analysis for all groups on the total number of training melodies to be different from any of the previous analyses. Differences of posttest-pretest means were significant at the one per cent level. Under number 2, it may be observed that there was an indication of significance at the five per cent level for: rhythm training, Experiment 1; interval training, Experiment 2; and tone group training, Experiment 3; class instruction during the sophomore year, and background factors.

Discussion

The inferences arising from these results are:

1. The organization of materials in contextual units, non-contextual units, or groups expanded was not a significant factor in learning the tasks of melodic perception. There was no evidence to support that any one method or organization of melodic material makes any difference for people to learn music. It cannot be said that one method was superior to the other.

2. There was no evidence that either aural or visual knowledge of results was a superior method for returning information about the melodies to students. In only one instance was there any evidence to support that knowledge of results did make a difference. In the correct identification of the octave aural knowledge of results was significant. This can be explained as follows; students who heard the melody and then heard the stated identification of the octave, were more cognizant of octave than

they were when they viewed the same melody printed form. Since Fundamentals of Music teachers consider this an important item in music learning, this research supports a technique of orally emphasizing the octave of a particular melody.

3. Data indicate an improvement between pre-posttest scores on every task with the exception of the identification of the correct octave. These data support the position that these methods of auto-instruction and melodic dictation were effective and can be used to advantage in a music instructional program.

4. "Other Factors" were significant in four of the analyses. The students' background played a great importance in their ability to learn specific knowledge and skills. There is every reason to believe that materials can be designed and auto-instructional methods developed which can give students the opportunity to prepare an adequate pre college background before entrance into a highly specialized program such as music.

5. Table LXXV, the analysis for the total number of correct training melodies, indicated that a high significance level for the auto-instructional training which was received by the students prior to the more sophisticated task of transcribing melodies. The data support that the methods were ordered and were needed to build specific skills and competencies in the longer and more complex music learning. The instruction students received in the classroom was also important and was necessary for their total improvement. There is no reason to believe that auto-instructional treatment alone produced a superior ability. As an adjunctive part of the classroom instruction the auto-instruction methods did assist the student to acquire skill and knowledge in the perception of rhythm, intervals, tone groups, and melodies.

PART VI

SUMMARY

There are a variety of ways in which information and materials may be presented to students for learning. Teachers prescribe a particular method for presenting information to students. The selection of the best method from alternative methods is a problem faced by teachers in all areas of learning. This research assumed that different methods of instruction could be developed and that these methods would have different effectiveness for different students. It is here implied that the need in education is the development of multiple methods which will be effective for teaching the same information to different students.

All higher education music curricula are based on the assumption that the technical knowledge of music is vital to the understanding of music and to the attainment of skills necessary to perform, to write, and to teach music. Presentation of materials is based on the same method of teaching as the teacher was taught. Disappointment in the learning achievement of students has been expressed by both teachers and students.

Students enter music instruction with varied backgrounds. Individual differences in learning are evident in the outset of the instructional program. Traditional classroom instruction has made it difficult to evaluate the individual differences in learning. Spohn developed methodology utilizing the laboratory situation with programed materials and self-presentation techniques to improve students' learning of intervals and rhythm. Spohn and Poland investigated the effects of aural and visual presentation of music materials. Voiced and written responses showed learning, using these materials and methods, to be greatly improved over traditional classroom instruction. Spohn's past research incorporated the advantages of self-presentation methods, which meant students could progress at their own rate. Information was presented to them in a uniform and consistent manner. There were no distractions while working on the materials. Irregularities in presentation were non-existent. Students were immediately informed as to the correctness of their answer. Even with this improved methodology, all students did not accomplish optimum learning on three elements of music: rhythms, intervals, and tone groups. The related research of Lindahl, Turner, and Fattu suggested to Spohn that alternative techniques utilizing the new methodology were needed. The problem of this research was to determine the best combination of various music stimulus perceptual material with two methods, aural and visual, to provide immediate knowledge of results for the learning of rhythm, intervals, tone groups, and melodies. Special programs were written which offered instruction in four categories of music: rhythm, intervals, tone groups, and music melodies. These programs were specially adapted for presentation on magnetic tape for use in The Ohio State University Music Audio-Visual Training Laboratory and four experiments were undertaken to investigate the effectiveness of the different experimental treatments.

Experiment 1 was to determine:

(1) whether one kind of rhythmic presentation (single tone source, melodic background, or taps) facilitated the learning of rhythm,

(2) whether one method of rhythmic presentation was more useful than another,

(3) whether a particular method of aural or visual knowledge of results facilitated the learning of rhythmic taps, single tone source rhythms, or rhythms presented with a series of tones, and

(4) whether one method of providing knowledge of results was more useful than another in learning a particular rhythmic presentation.

The experiment which investigated this learning was undertaken with the freshman class at the School of Music, The Ohio State University in the fall 1963. Pretest scores indicated that the students entered the School of Music with a lack of proficiency in transcribing rhythms. Posttest means indicated an improvement in this task which was shown to be statistically significant in each case. Two separate analyses were undertaken; one which included all students in the experiment, the second analyses was undertaken with only those students who completed the freshman year in the School of Music. The analysis undertaken for the larger groups of students, those who completed the experiment, showed no difference in learning from the different rhythmic presentations. The second analysis, however, which included only those students who had completed the freshman theory sequence, clearly indicated that the rhythmic presentation which utilized the single tone source for rhythmic presentation was the most effective method. Rhythmic presentation with taps was also effective for learning, however, not as effective as the single tone source method. Rhythms presented with a melodic background as a means of learning was clearly shown to be the least effective of the three presentations. There was no evidence that either visual knowledge of results or aural knowledge of results was more beneficial than the other for learning rhythm.

Experiment 2, Intervals, was to determine:

(1) whether the use of a particular method of interval presentation, ascending, descending, or harmonic, facilitated the learning of intervals,

(2) whether one method of interval presentation was more useful overall than any other,

(3) whether a particular method, either aural or visual knowledge of results facilitated learning of any of the three interval presentations,

(4) whether one method of providing knowledge of results was more useful than another in learning a particular interval presentation.

The data showed that the ascending melodic interval presentation was overall the more effective method. The task of learning descending melodic intervals was found to be difficult when compared to either ascending melodic interval presentation or harmonic interval presentation. It was suggested from this research that an effective ordering of the presentation for interval instruction would be (1) ascending, (2) harmonic, (3) descending. There was no evidence that either method of immediate knowledge of results was more effective than the other for learning any of the interval presentations. There was evidence that some students need only the one method of interval presentation and make use of this ability to identify other methods of presenting intervals.

There were two analyses undertaken for two groups of people; all those who completed the experiment, and those students who continued throughout the freshman year. There were no major differences between the two analyses. There were, however, higher significant levels indicated from the analyses due to the different experimental treatments for those students who completed the freshman theory sequence.

Experiment 3, Tone Groups, was to determine:

(1) whether the use of an ascending pattern, a descending pattern, or a pattern of ascending and descending tone groups facilitated the learning of this music group,

(2) whether one of the methods of presentation was more useful for students than another for learning tone groups,

(3) whether an aural or visual method for providing knowledge of results facilitated the learning of a particular pattern, and

(4) whether one method of knowledge of results (either aural or visual) was more useful than another in learning a particular pattern of tone group presentation.

The data indicated that the organization of pitches by direction was helpful for learning to perceive tone groups. Either direction, ascending or descending, appeared to be more effective for learning tone groups than tone groups presented in an ascending and descending direction within the same group. There was no evidence that either aural knowledge of results or visual knowledge of results was more effective than the other for students' learning of tone groups. There was evidence to support that previous instruction received by the students in Experiment 2, Intervals, influenced the learning of tone groups.

Experiment 4, Melodies, was to determine:

(1) whether the task of transcribing melodies was learned better by; (a) complete melodies given to the students, (b) drills utilizing problems from the melody, or (c) small units of music (tone groups) which were progressively expanded into longer and more complex units of music,

(2) whether one of the above organizational patterns was overall more effective for students than another in learning music,

(3) whether either aural or visual knowledge of results facilitated learning of one of the above material organizational patterns, and

(4) whether aural or visual knowledge of results was more useful for one or another in learning a particular organizational pattern of music. The data indicated that all three methods were effective for students to learn to transcribe melodies.

From the data it was determined that each method was as effective as the other for learning. There was no evidence that either aural knowledge of results or visual knowledge of results was more effective for learning to transcribe melodies. There was evidence that all of the laboratory instruction received in Experiments 1, 2, and 3, as well as the classroom instruction received the quarter of the experiment was important to the overall improvement of the students' ability to transcribe melodies. In every experiment and from every analysis within each experiment, there was evidence to indicate the importance of background factors in students' learning. Each of the methods tested in this research was shown to be effective for learning. The research which proceeded this report indicated that learning undertaken by these methods in the laboratory provided a superior method for learning than learning which took place in the traditional classroom. The methods investigated in this report add to the total number of methods which have been proven an effective way of learning music.

There is, however, a great unexplored region which only future research can map and that is to investigate the individual differences and attempt to determine from these differences the appropriate methods which will be most effective for an individual to learn the elements of music; rhythm, intervals, tone groups, and melodies. It is obvious from the data that students respond differently to different methods and that the need is to diagnose the differences and have the appropriate methods available to meet the individual differences and thereby achieve learning for those students interested in learning music.

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APPENDIX A

TONE GROUP INSTRUCTIONAL MATERIAL

NAME________________ TITLE TGB 10________ NO.________

COURSE________ INSTRUCTOR________ DATE________ BOOTH________

A 1		2		3		4		5		6	
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B 1		2		3		4		5		6	
M3	m3	m2	M2	M2	M2	m3	P4	M2	M2	M3	m3

C 1		2		3		4		5		6	
M2	m2	M3	m3	m2	M2	M2	m2	m2	M2	P4	M3

D 1		2		3		4		5		6	
P4	M3	m3	P4	P4	M3	m3	P4	P4	M3	m3	P4

NAME______ TITLE TGB 20 NO.______

COURSE______ INSTRUCTOR______ DATE______ BOOTH______

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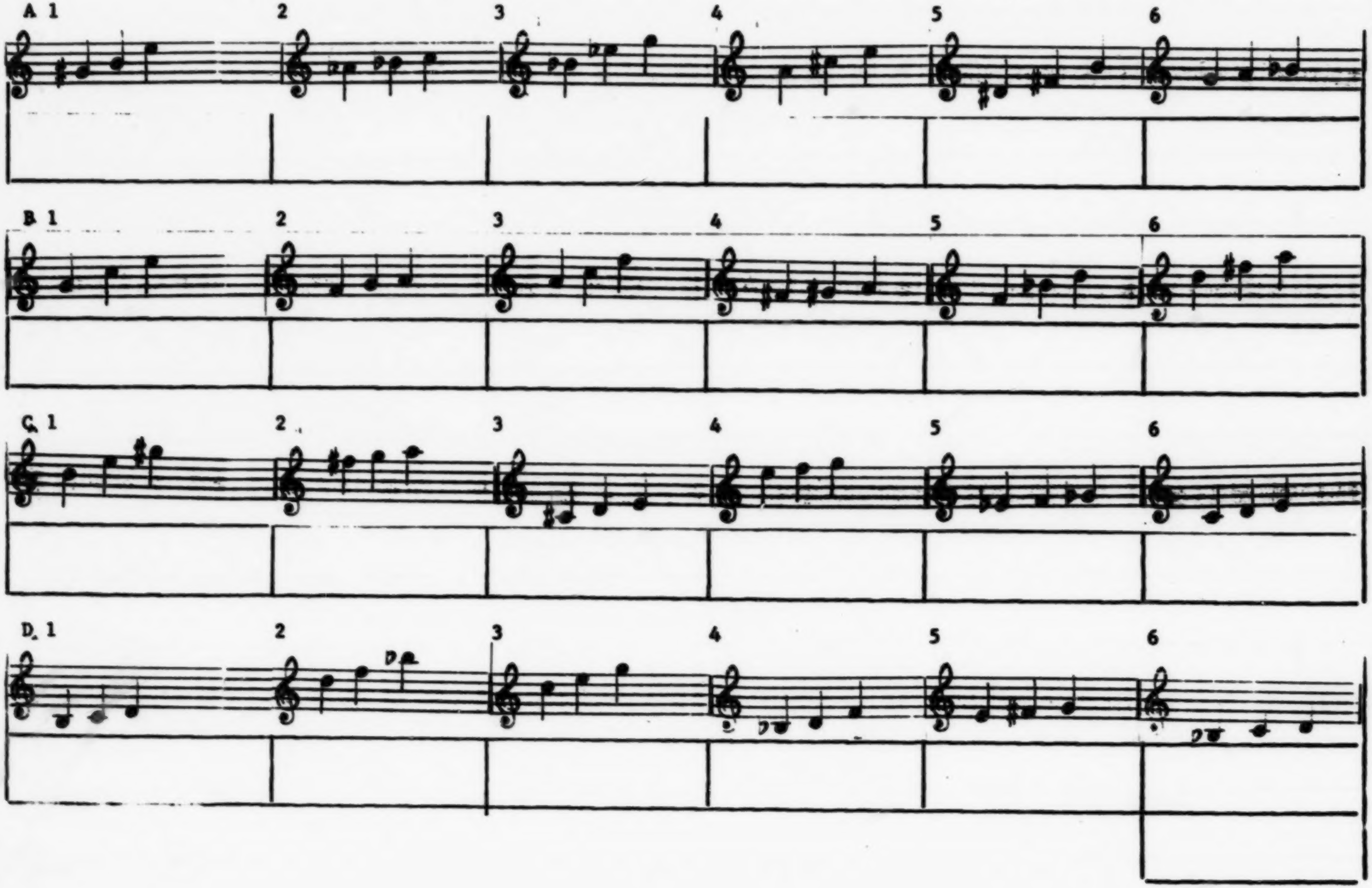
B 1		2		3		4		5		6	
M3	T	m3	M3	m3	M3	T	M2	m3	M3	M2	M3

C 1		2		3		4		5		6	
M3	P4	T	M2	P4	m3	M2	M3	M3	P4	M3	T

D 1		2		3		4		5		6	
P4	m3	T	M2	M3	P4	M2	M3	P4	m3	M3	P4

NAME________________________ TITLE TGB 30 ____________ NO.________________

COURSE______________ INSTRUCTOR________________________ DATE__________ BOOTH__________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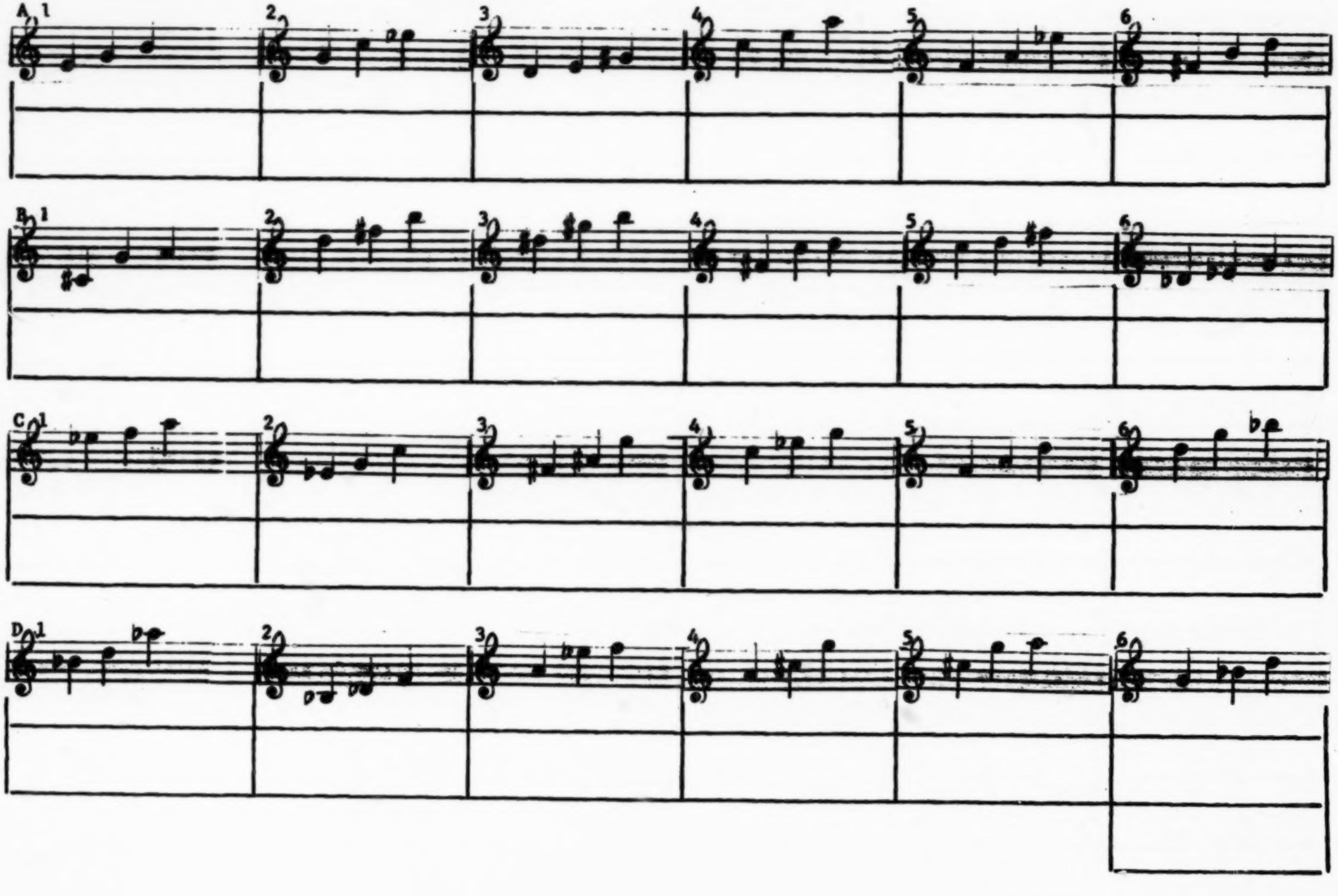
NAME_______________ TITLE TGB 40 NO._______________

COURSE_______________ INSTRUCTOR_______________ DATE_______________ BOOTH_______________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C 1
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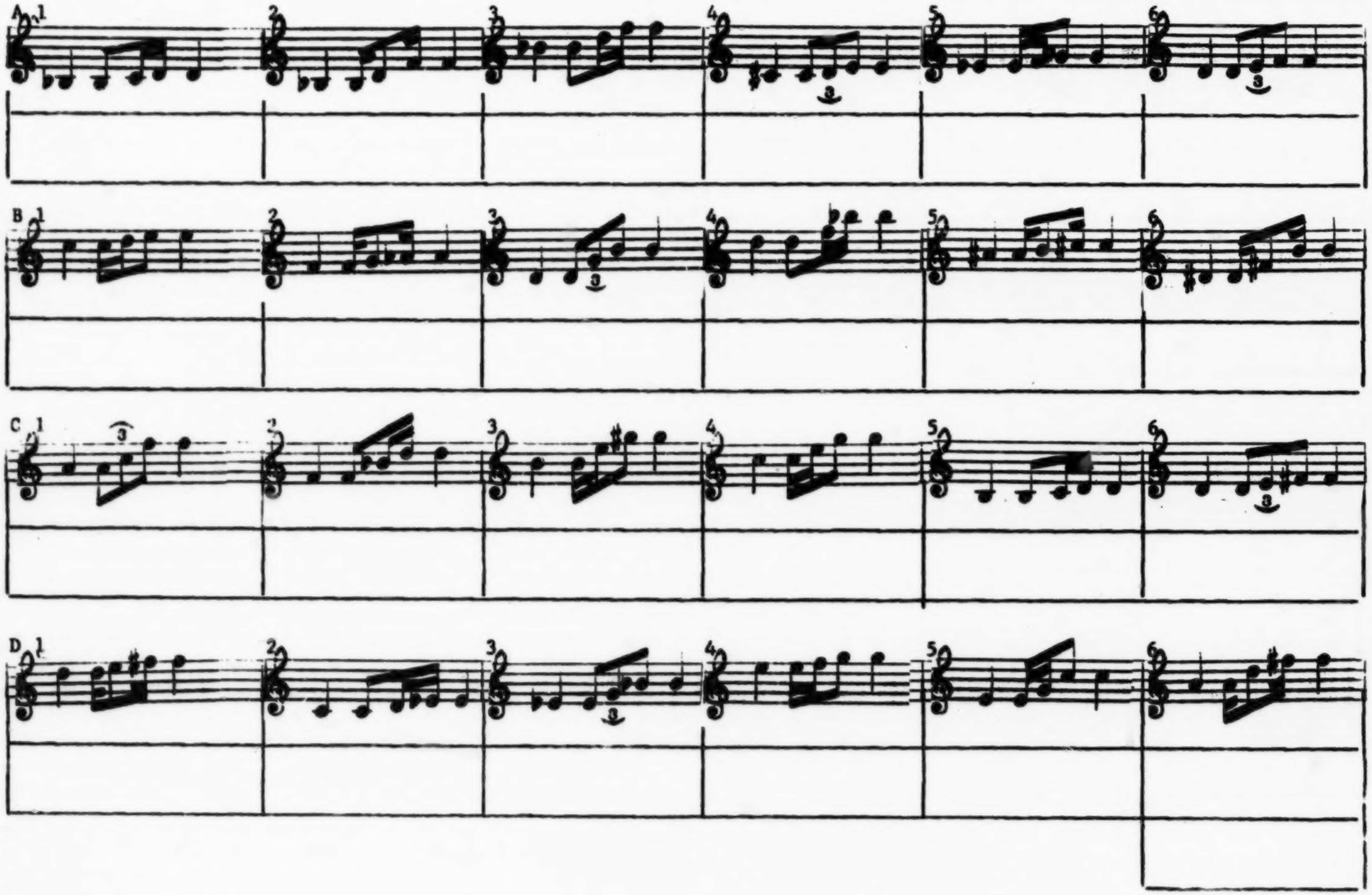
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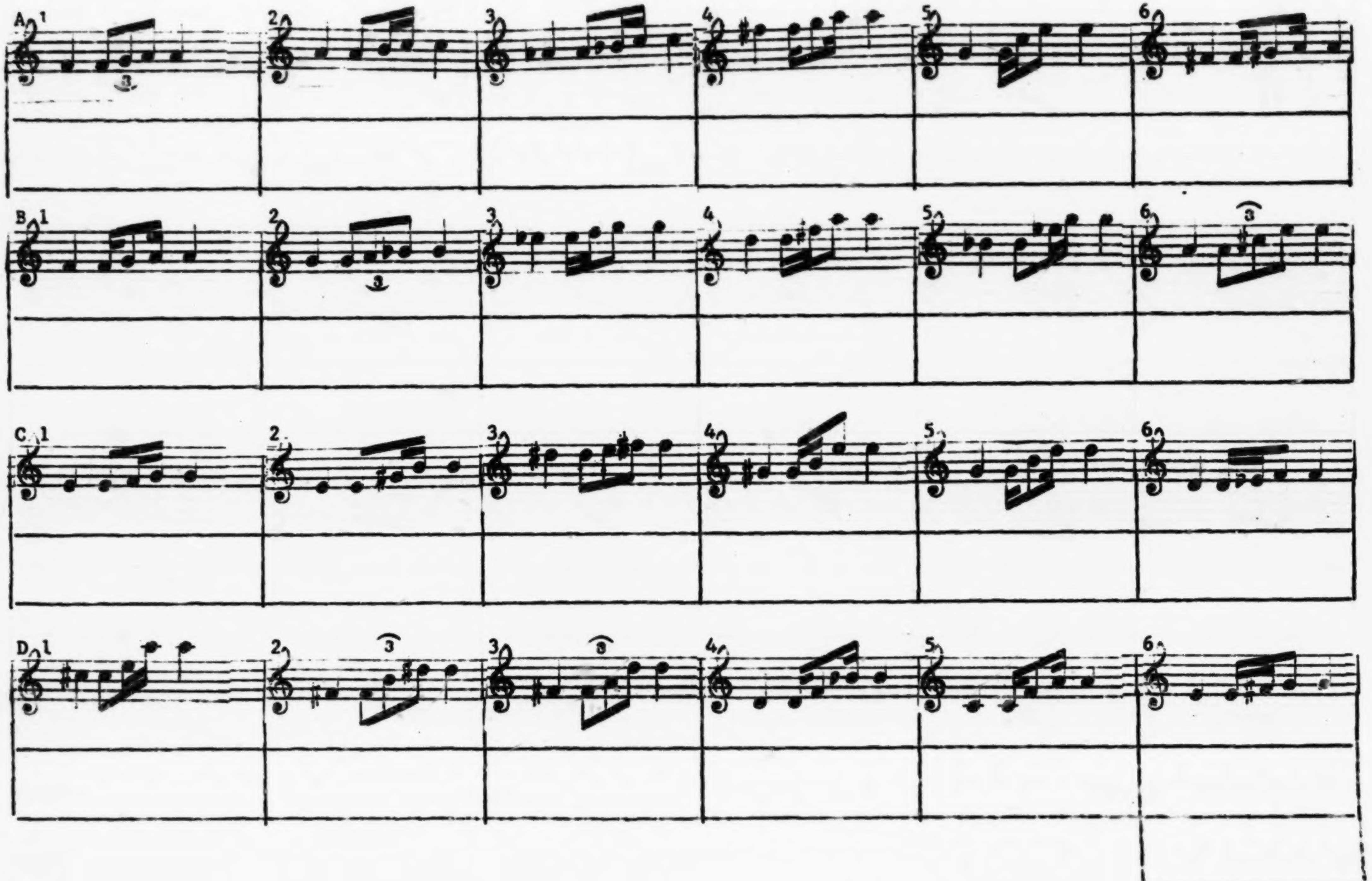
COURSE__________ INSTRUCTOR__________ DATE__________ BOOTH__________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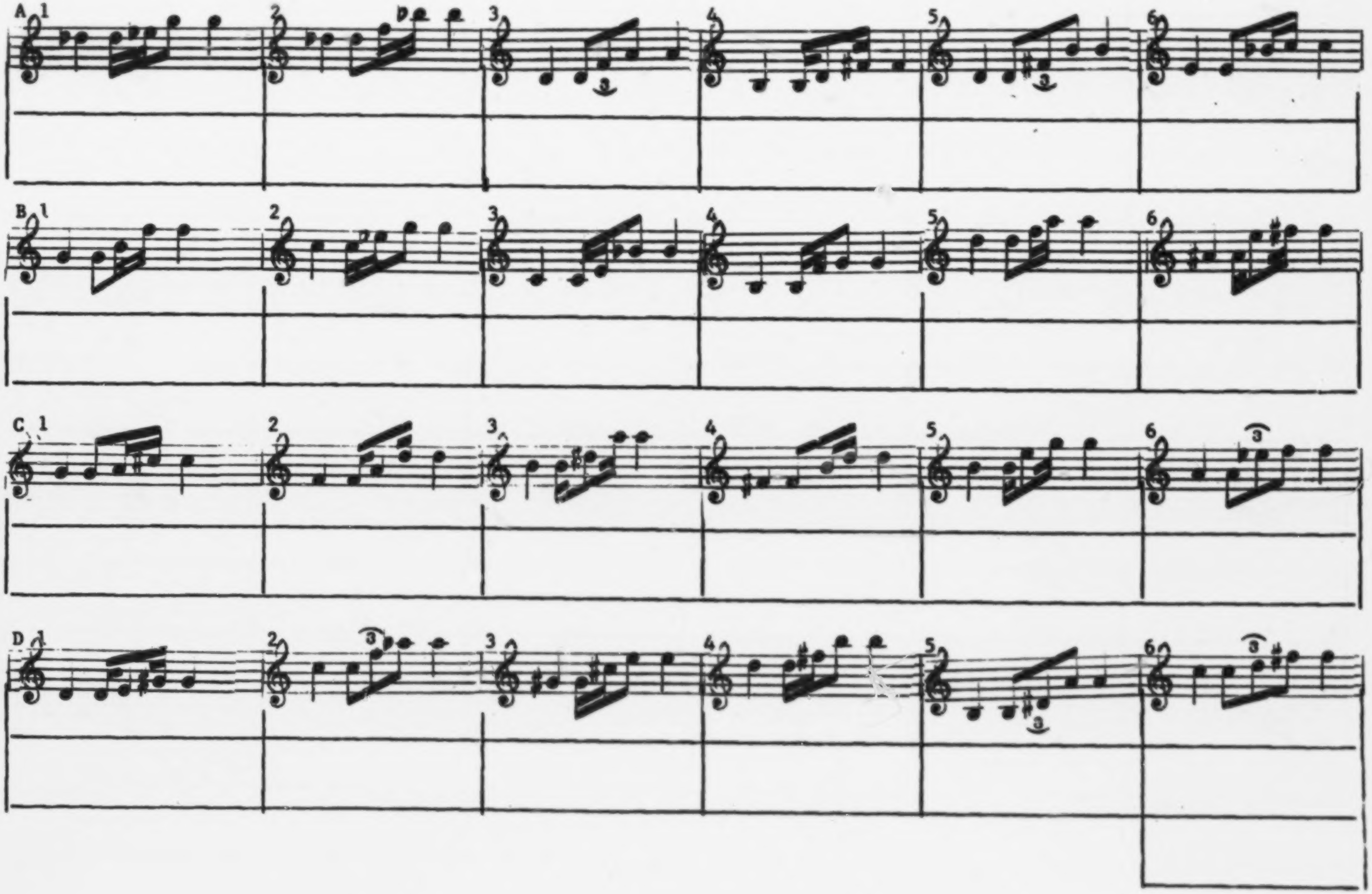
COURSE __________ INSTRUCTOR __________ DATE __________ BOOTH __________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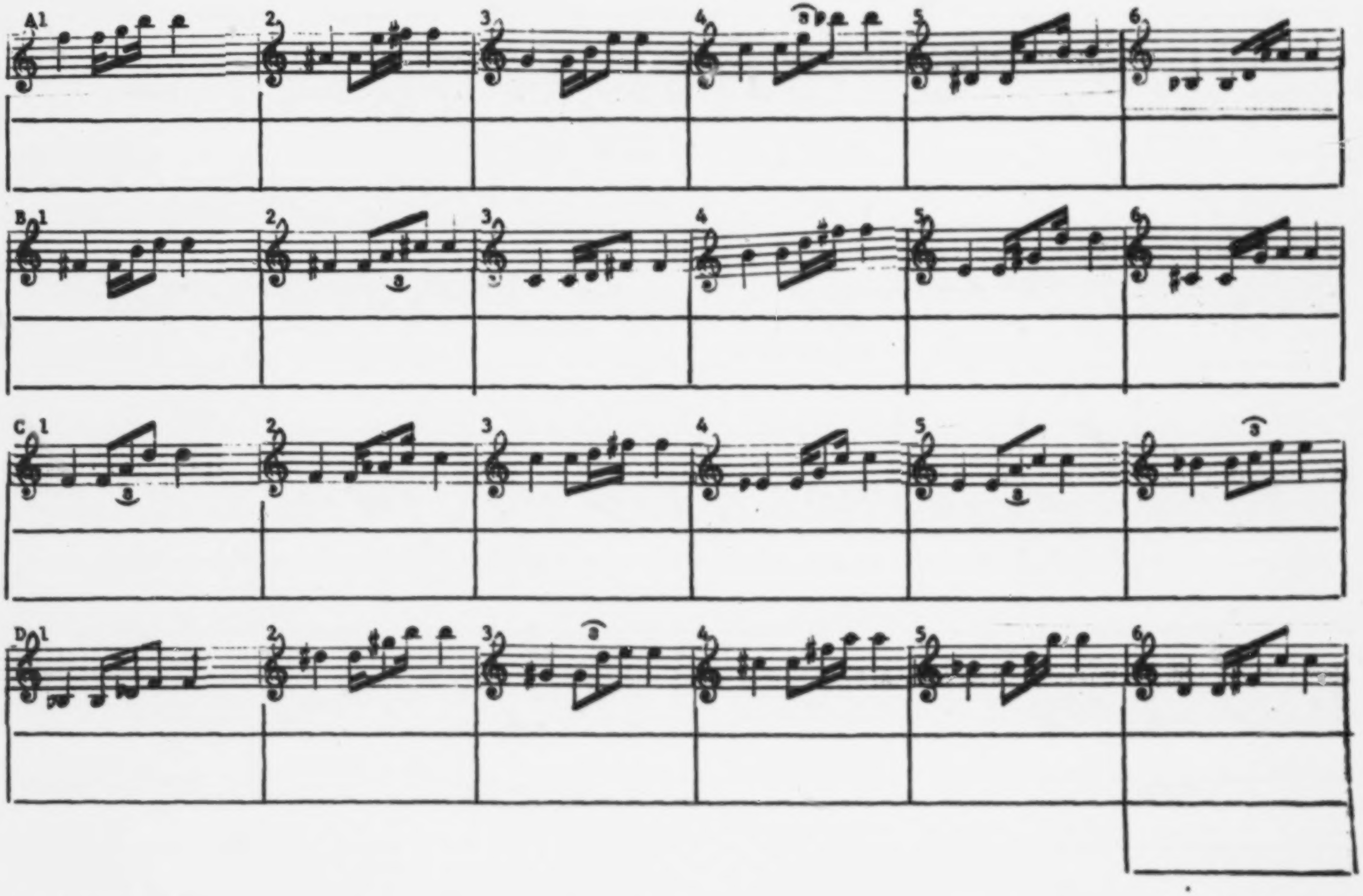
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B 1
C 1
D 1
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NAME____________________ TITLE TGC 10 ______ NO.__________

COURSE__________ INSTRUCTOR__________ DATE__________ BOOTH__________

A 1		2		3		4		5		6	
M2	M2	m3	M3	m2	M2	M2	M2	m2	M2	M2	m2

B 1		2		3		4		5		6	
m3	M3	M2	m2	M2	M2	P4	m3	M2	M2	m3	M3

C 1		2		3		4		5		6	
m2	M2	m3	M3	M2	m2	m2	M2	M2	m2	M3	P4

D 1		2		3		4		5		6	
M3	P4	P4	m3	M3	P4	P4	m3	M3	P4	P4	m3

NAME__________ TITLE TGC 20 ______ NO.__________

COURSE________ INSTRUCTOR________ DATE________ BOOTH________

A 1		2		3		4		5		6	
T	M3	M3	M2	T	M3	M3	m3	P4	M3	M2	T

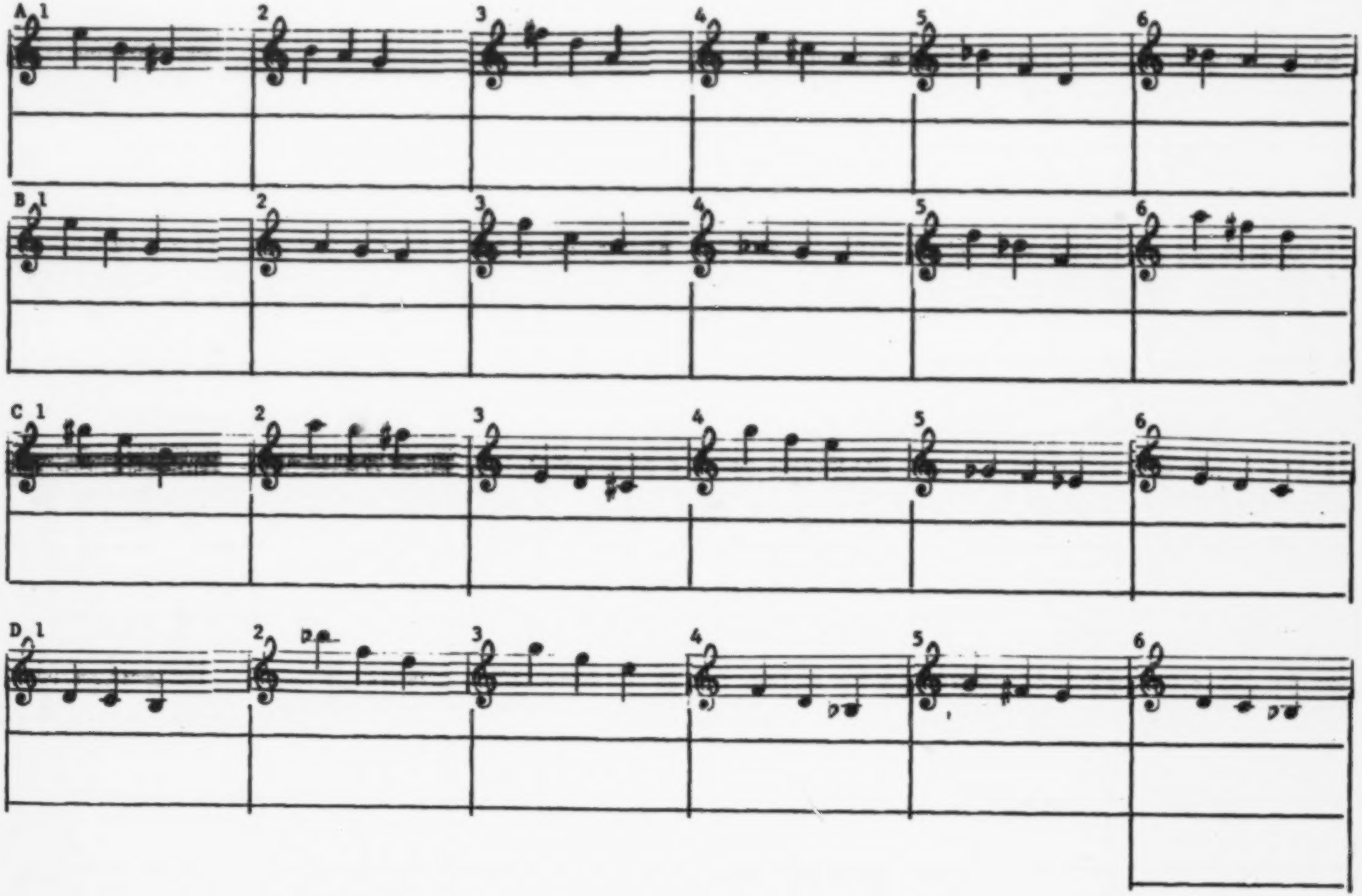
B 1		2		3		4		5		6	
T	M3	M3	m3	M3	m3	M2	T	M3	m3	M3	M2

C 1		2		3		4		5		6	
P4	M3	M2	T	m3	P4	M3	M2	P4	M3	T	M3

D 1		2		3		4		5		6	
P4	M3	M2	T	P4	M3	M3	M2	m3	P4	P4	M3

NAME____________________ TITLE TGC 30 ________ NO.____________

COURSE____________ INSTRUCTOR____________ DATE__________ BOOTH________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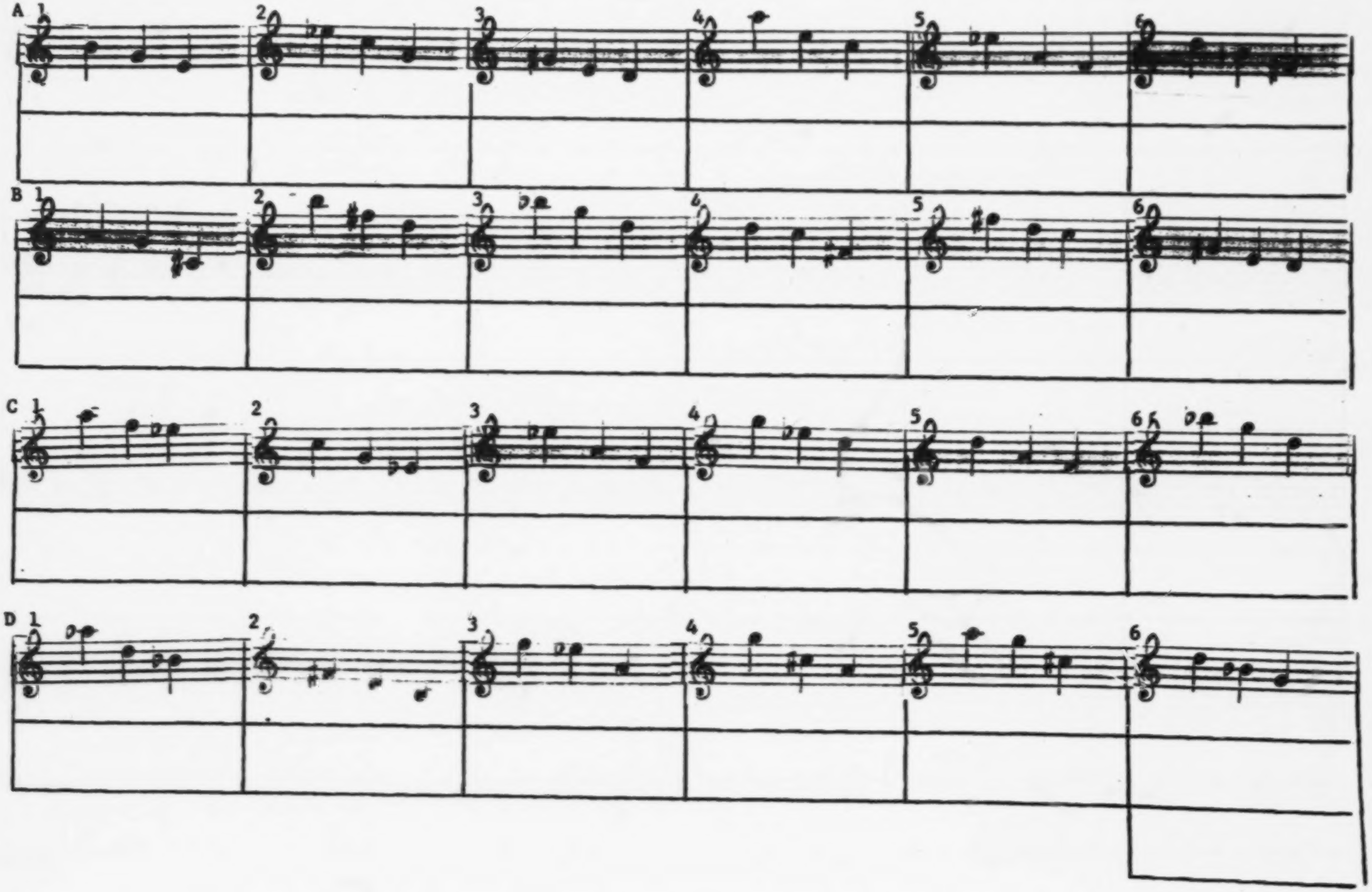
NAME________________ TITLE TGC 40 ________ NO.________________

COURSE________________ INSTRUCTOR________________ DATE________ BOOTH________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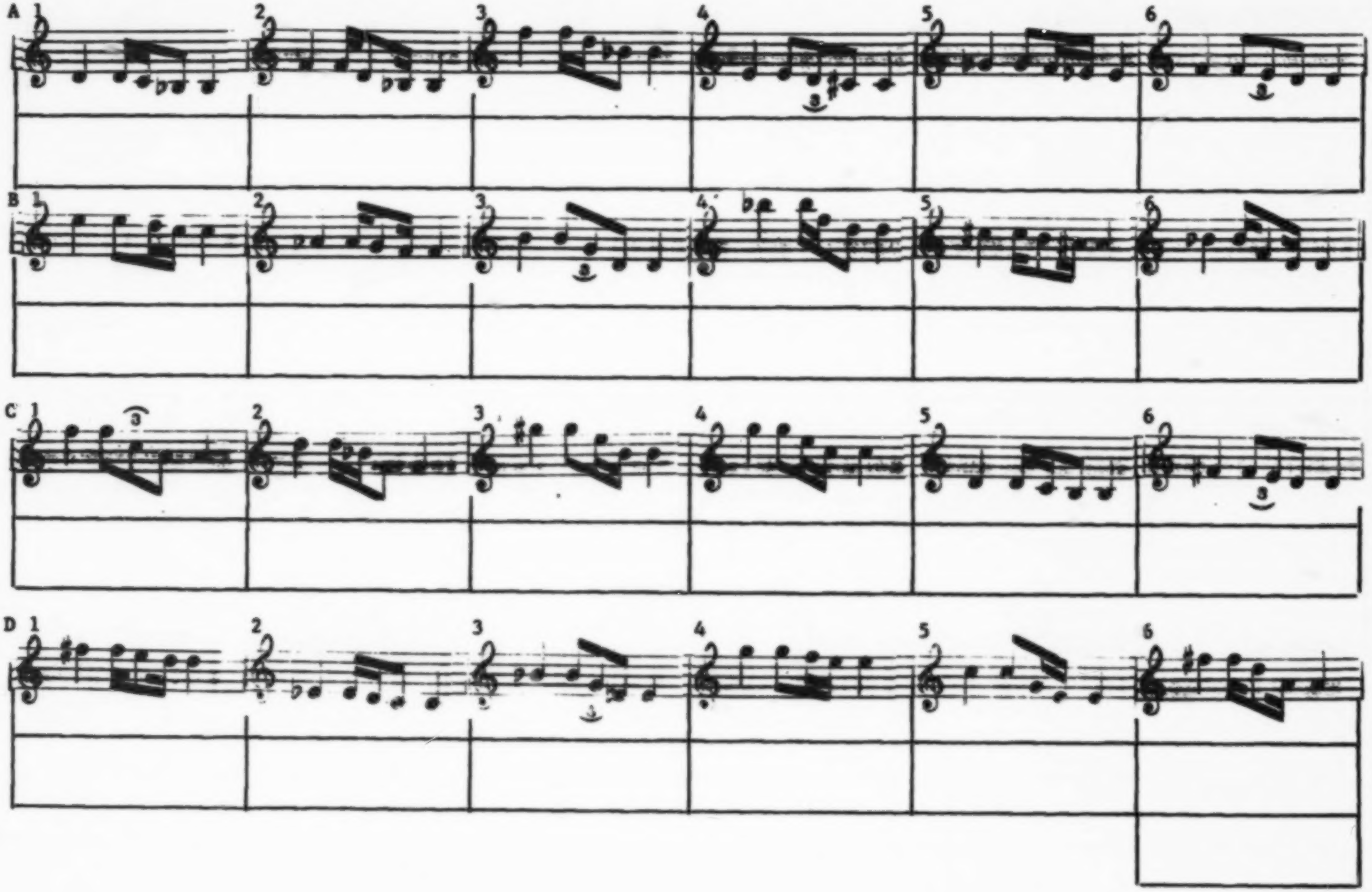
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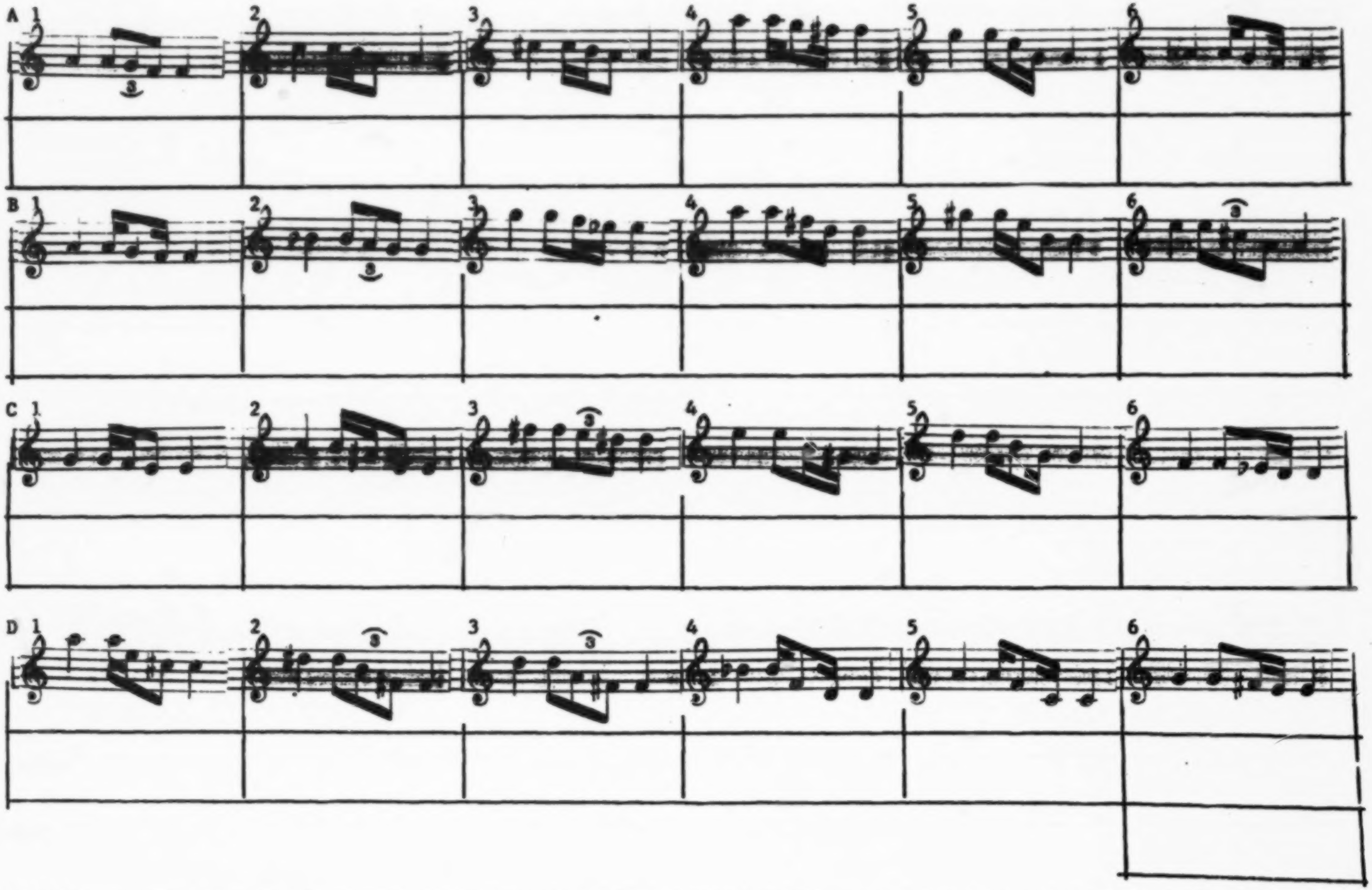
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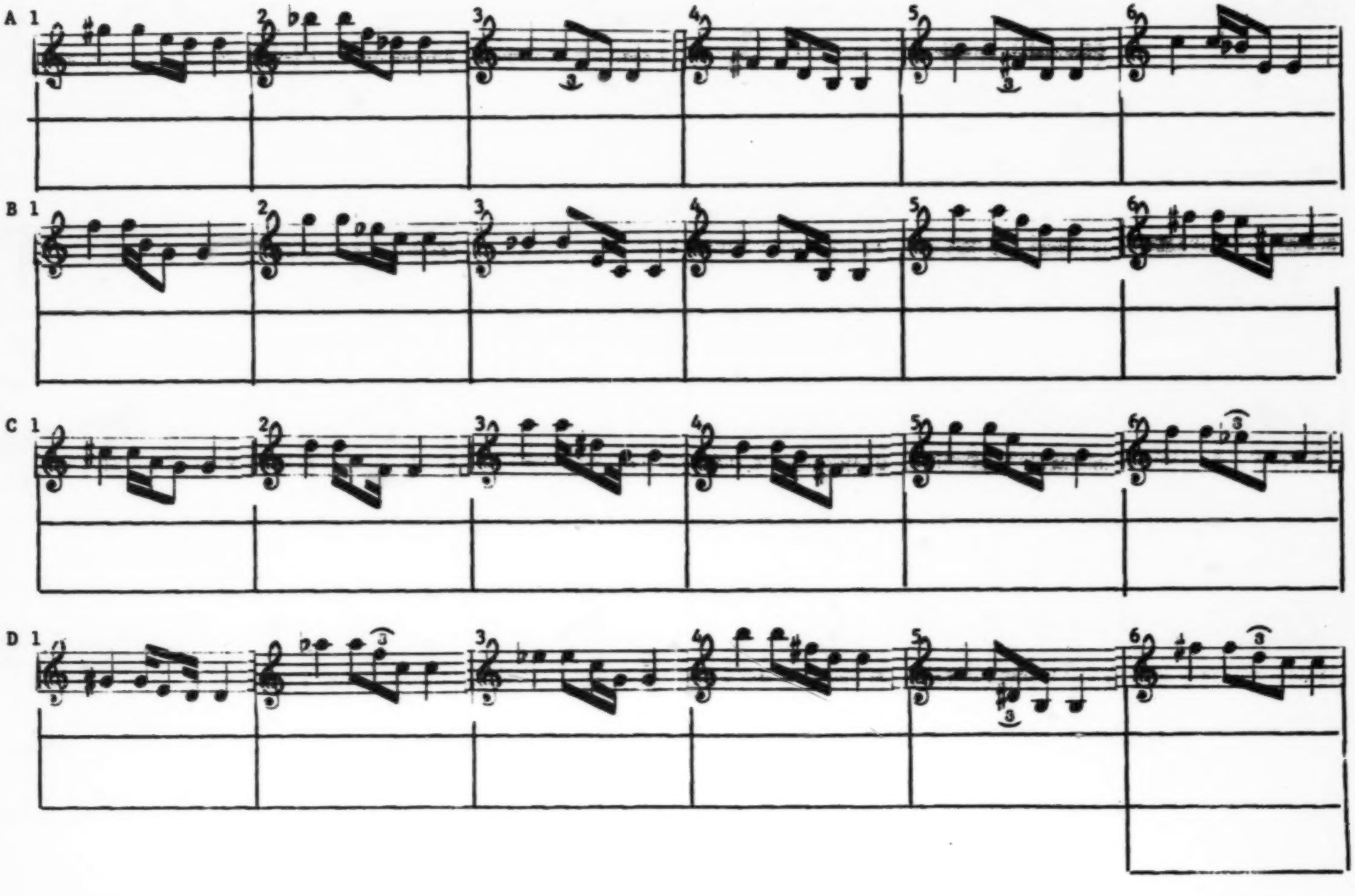
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NAME____________________ TITLE TGC 80 NO.__________

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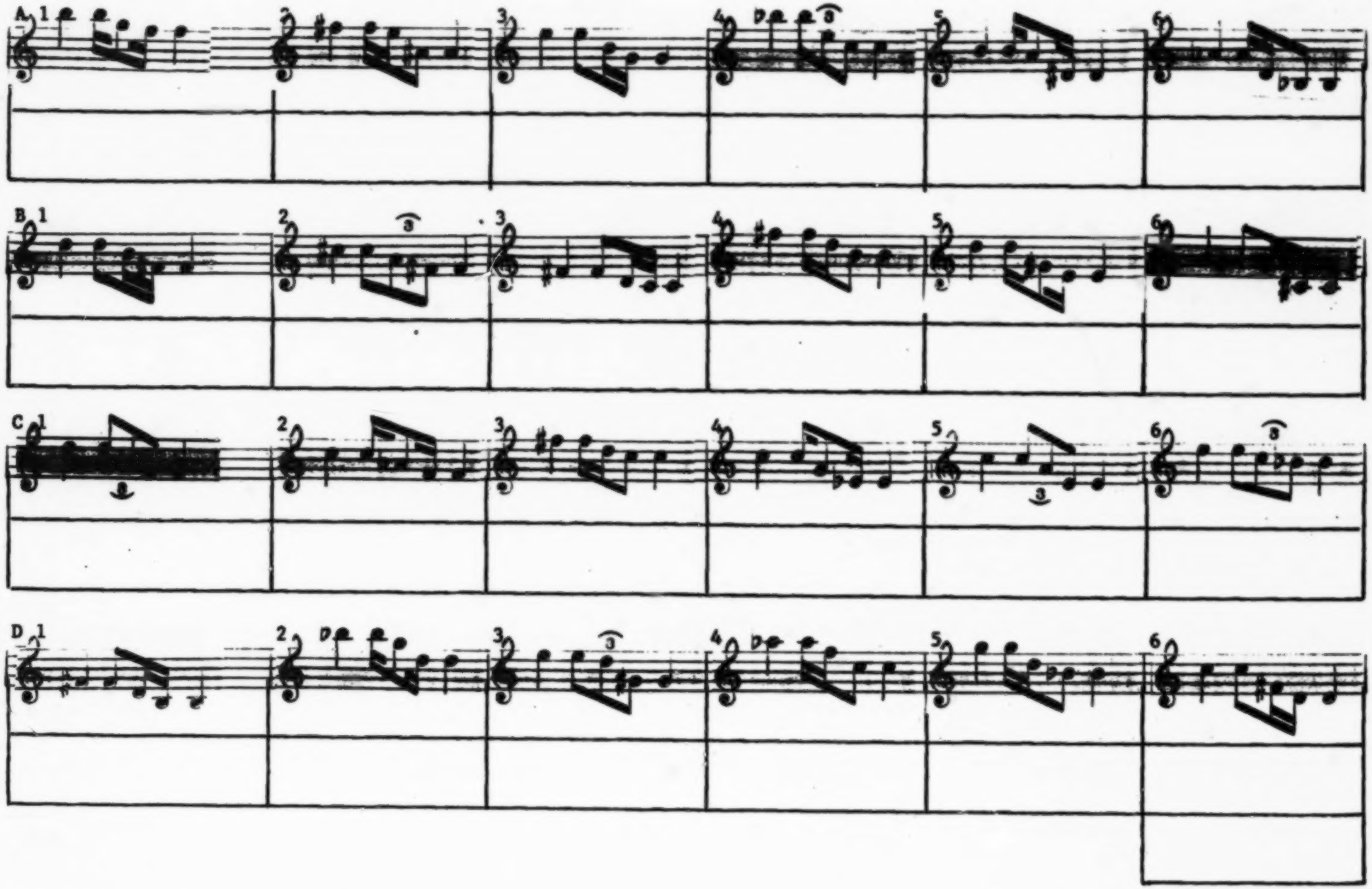
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NAME________________ TITLE TGD 10 ________ NO.________

COURSE________ INSTRUCTOR________________ DATE________ BOOTH________

A 1		2		3		4		5		6	
M2	m7	M3	M6	M2	M7	M2	m7	M2	M7	m2	m7

B 1		2		3		4		5		6	
M3	M6	m2	m7	M2	m7	m3	P5	M2	m7	M3	M6

C 1		2		3		4		5		6	
M2	M7	M3	M6	m2	m7	M2	M7	m2	m7	P4	m6

D 1		2		3		4		5		6	
P4	m6	m3	P5	P4	m6	m3	P5	P4	m6	m3	P5

NAME________________ TITLE TGD 20 ________ NO.________

COURSE________ INSTRUCTOR________ DATE________ BOOTH________

A 1		2		3		4		5		6	
M3	T	M2	m6	M3	T	m3	m6	P4	M6	T	m7

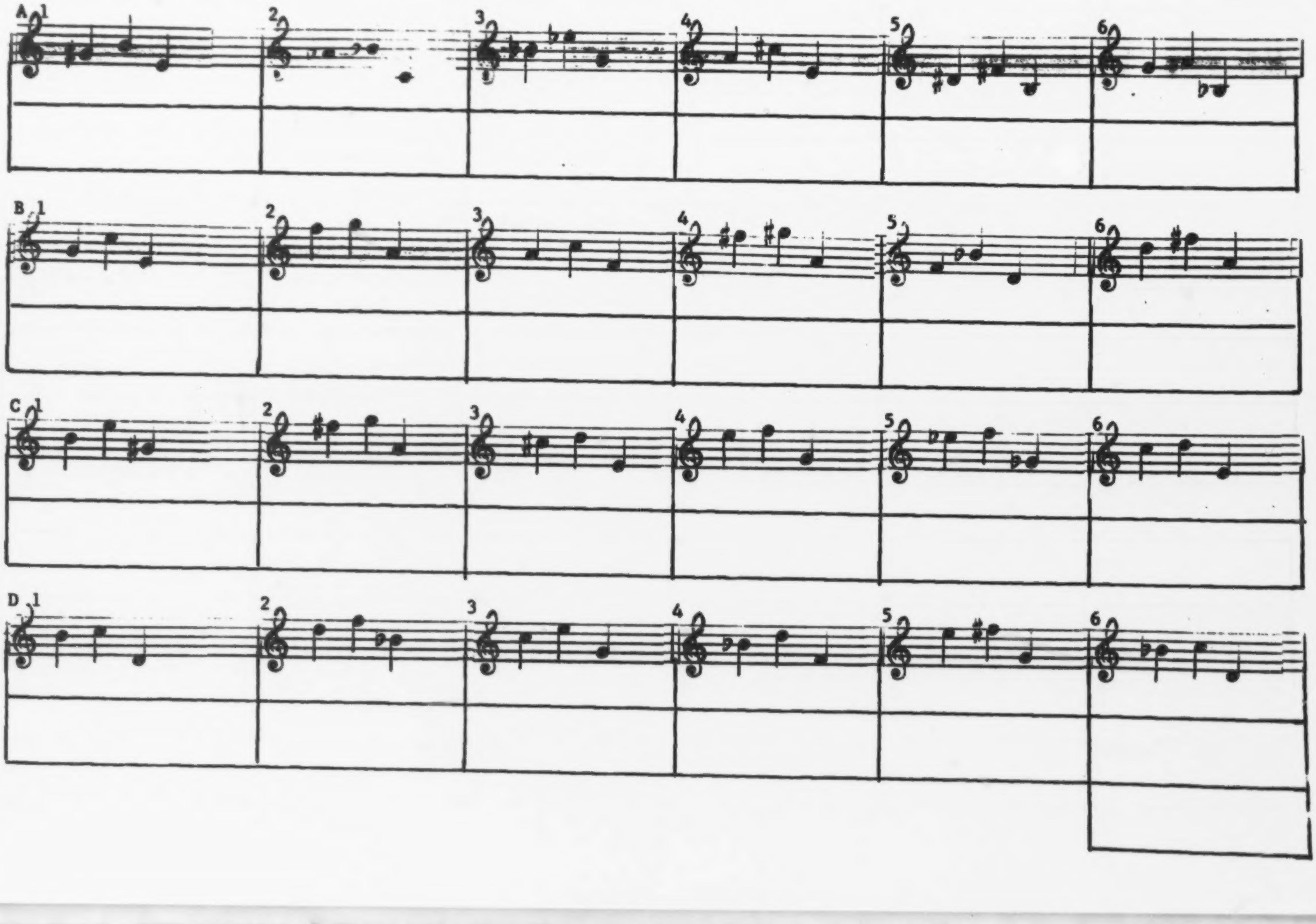
B 1		2		3		4		5		6	
M3	T	m3	m6	m3	m6	T	m7	m3	m6	M2	m6

C 1		2		3		4		5		6	
M3	P5	T	m7	P4	M6	M2	m6	M3	P5	M3	T

D 1		2		3		4		5		6	
P4	M6	T	m7	M3	P5	M2	m6	P4	M6	M3	P5

NAME____________________ TITLE TGD 30 NO.________

COURSE__________ INSTRUCTOR__________ DATE________ BOOTH________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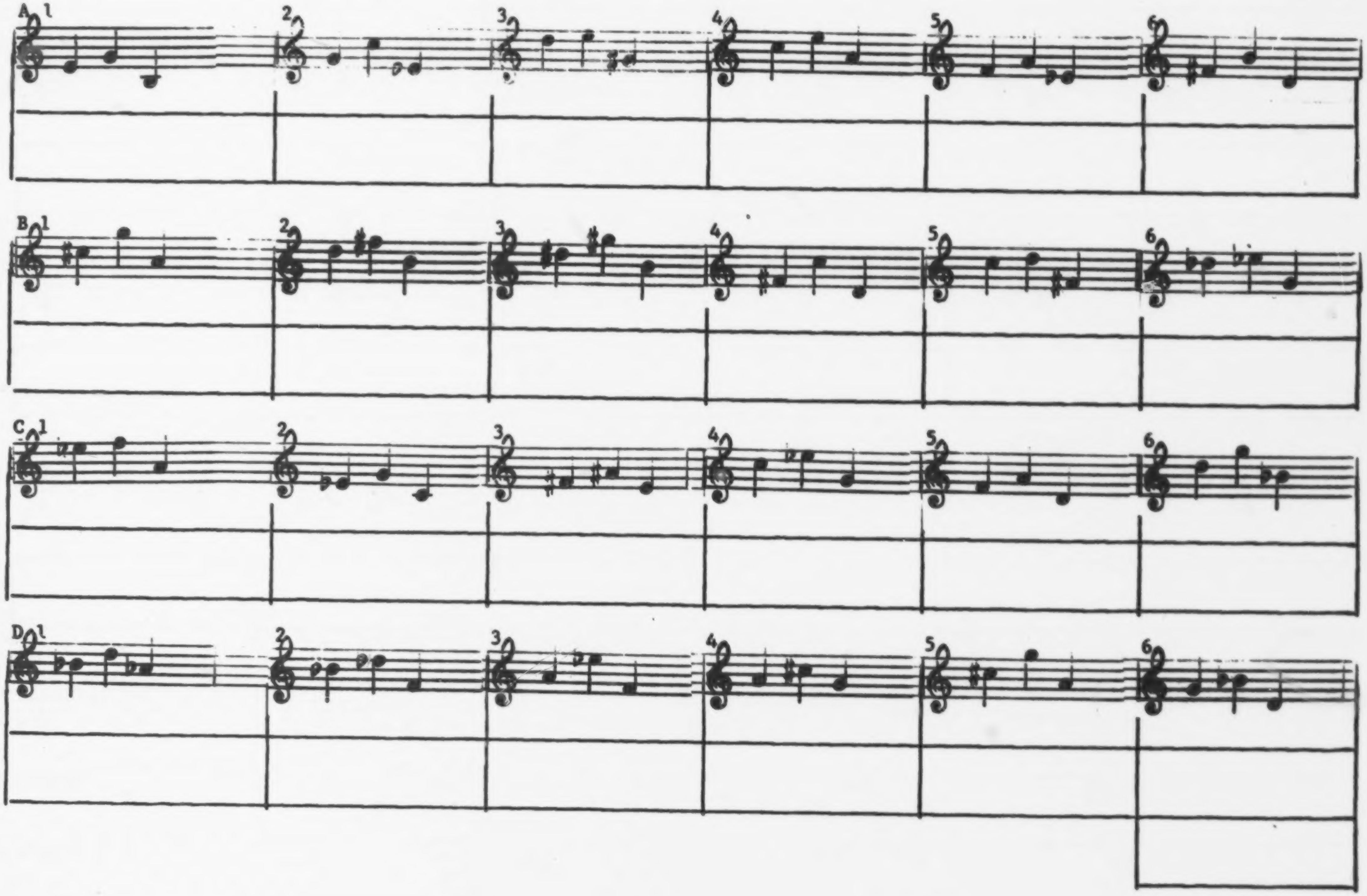
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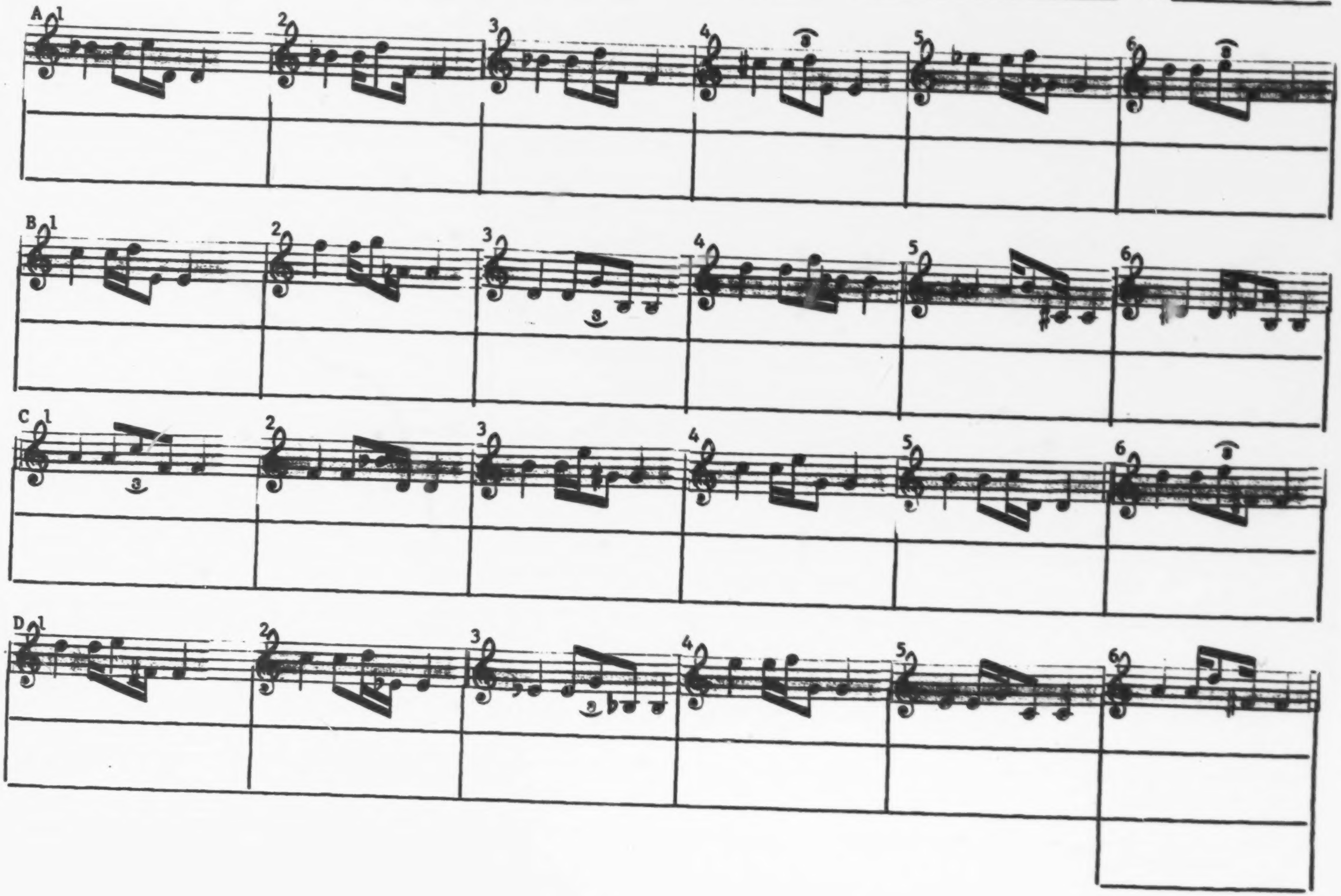
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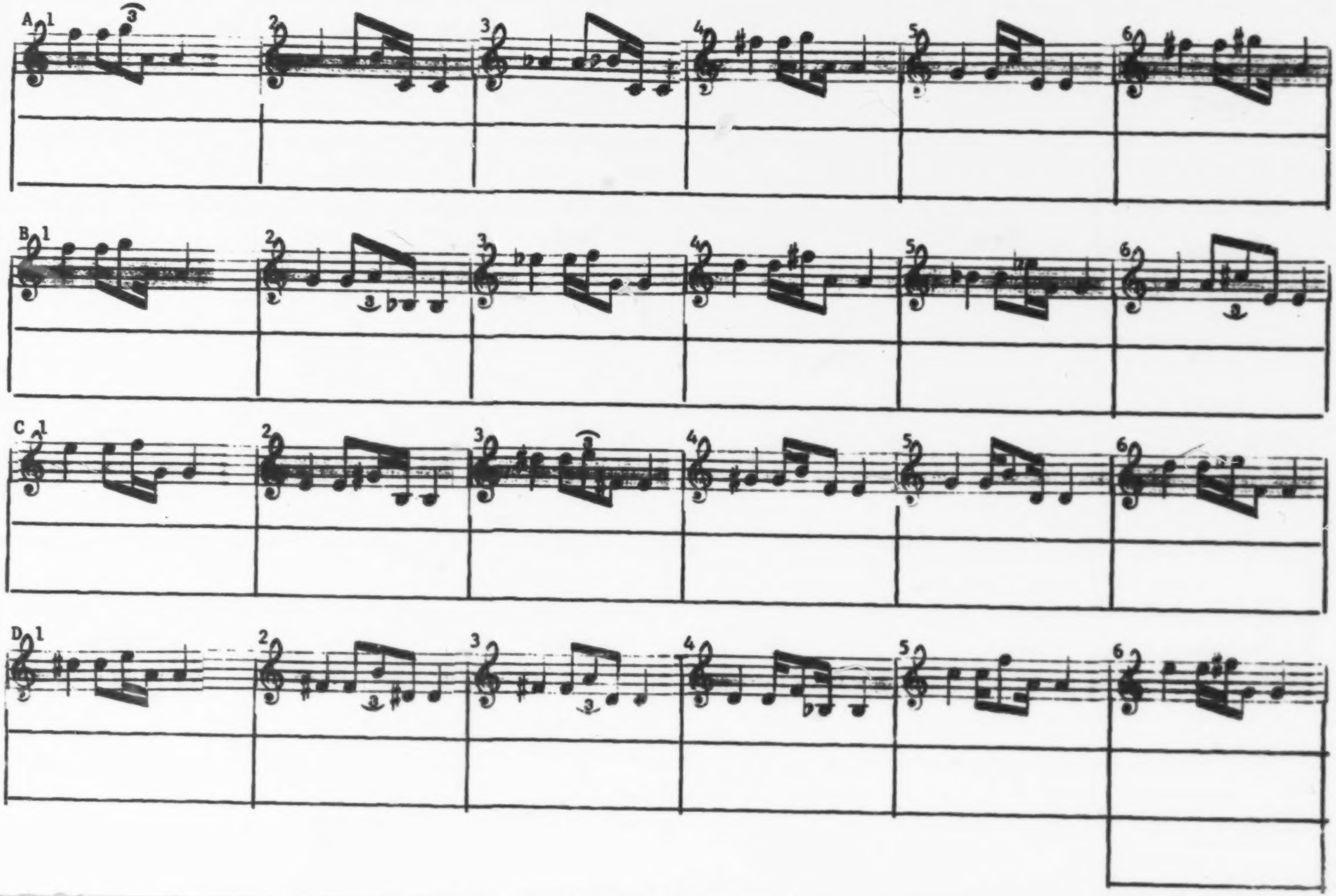
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NAME__________ TITLE TGD 70 NO.__________

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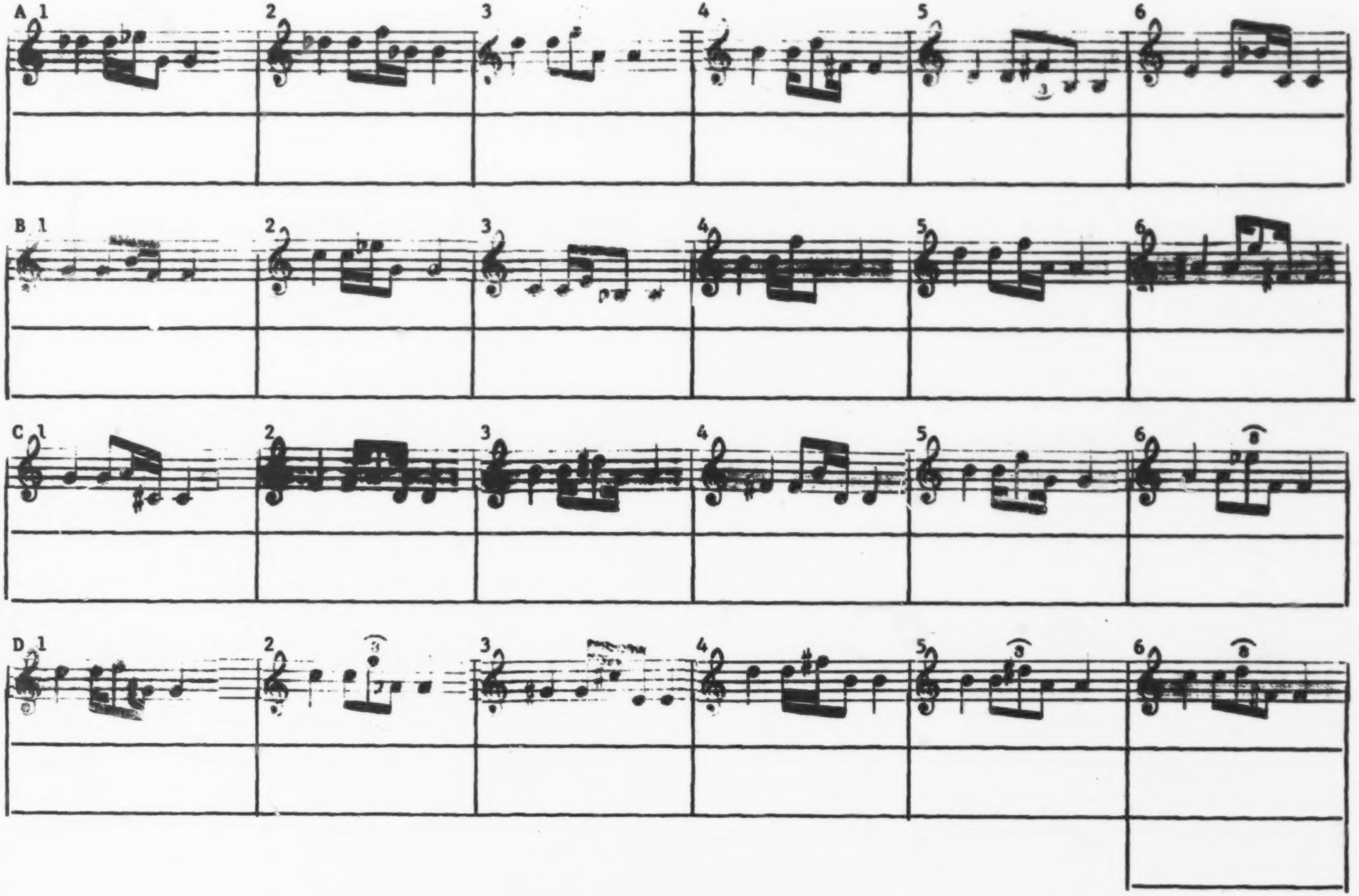
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B 1
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C 1
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D 1
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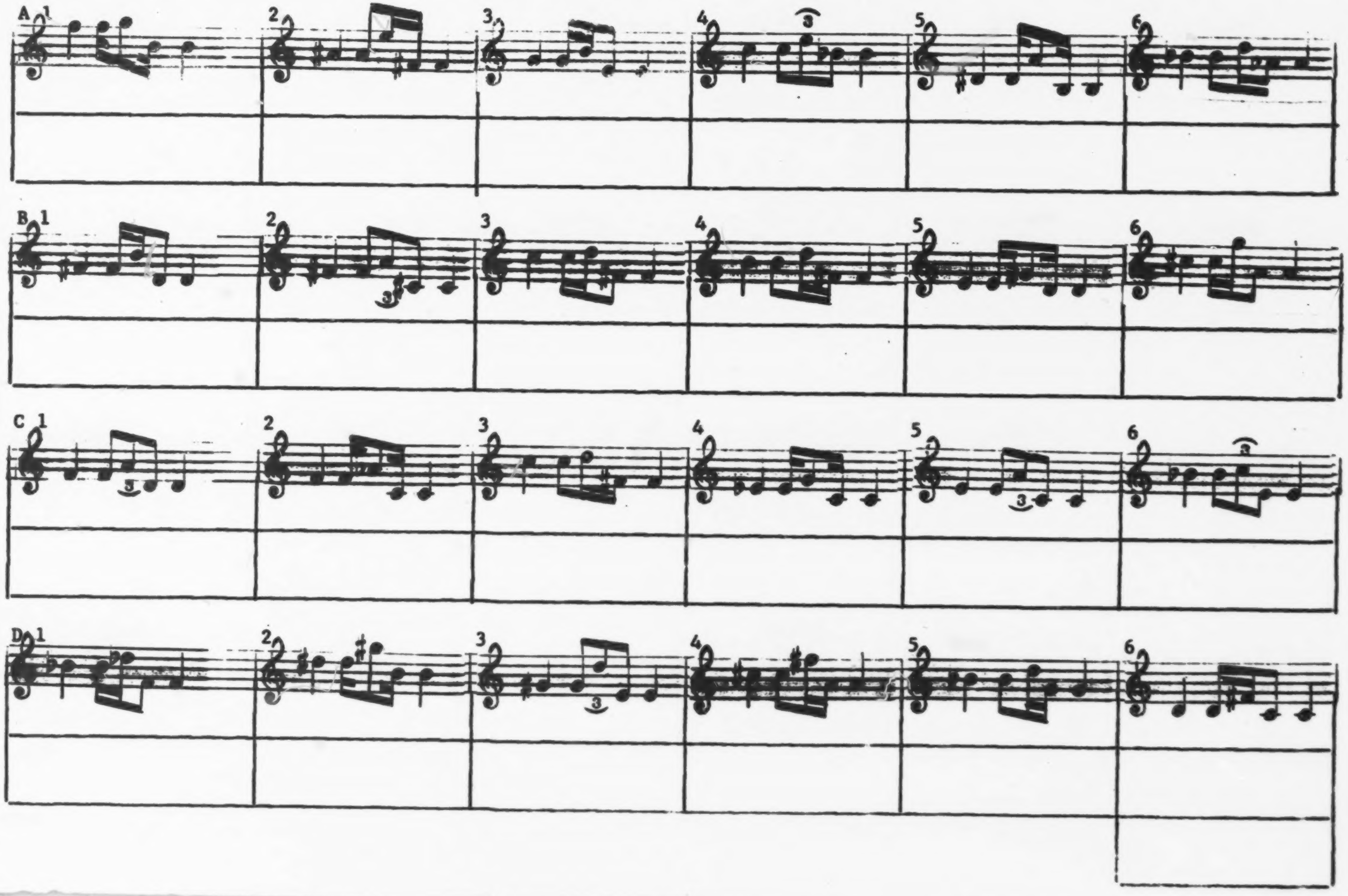
NAME____________________ TITLE ___TGD 80___ NO.________

COURSE____________ INSTRUCTOR____________ DATE__________ BOOTH________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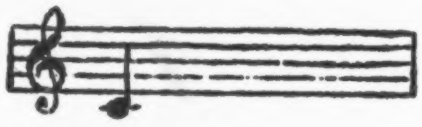
APPENDIX B

TONE GROUP PRE AND POSTTEST

MELODIC TEST

This is the first section of a three part test in which you are asked to identify three beat melodic groups (Tone Groups) presented in three different ways. In each part of the test you will see the first note for each tone group printed on the answer form. The tone groups will be played on the piano and you will be given ten metronome beats in which to write with notation the rhythm and pitches on the staff. In all parts of the test EACH tick of the metronome equals the EIGHTH-NOTE, therefore, there will be TWO TICKS PER QUARTER-NOTE value. The tone groups in Part I will be played in an ascending pattern.

Here is an example:



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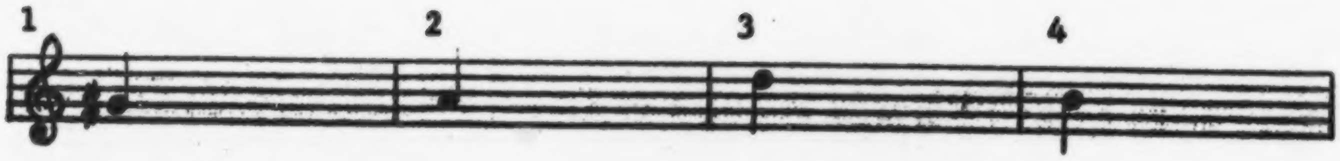

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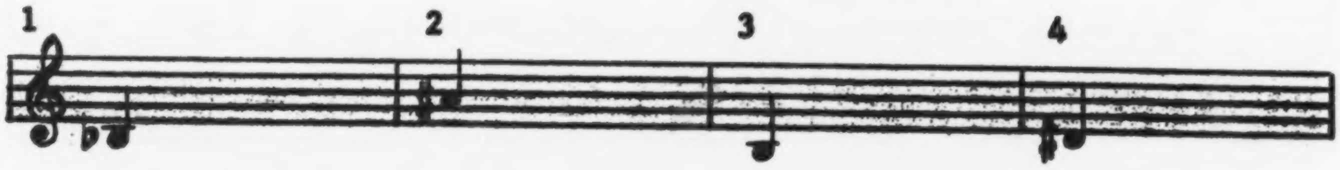

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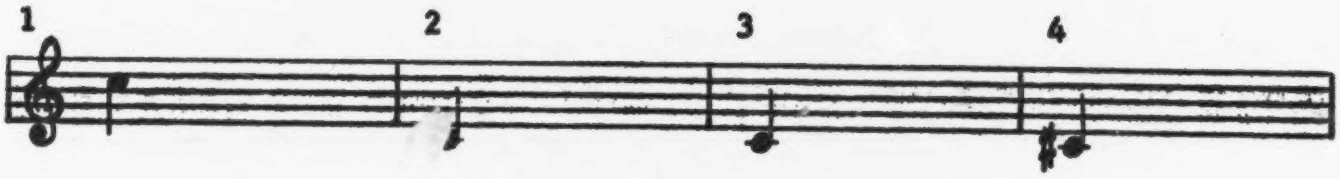

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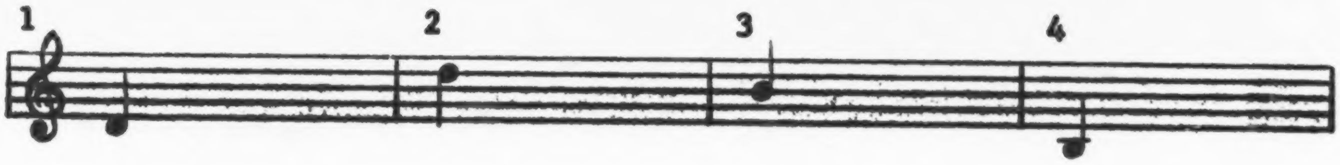

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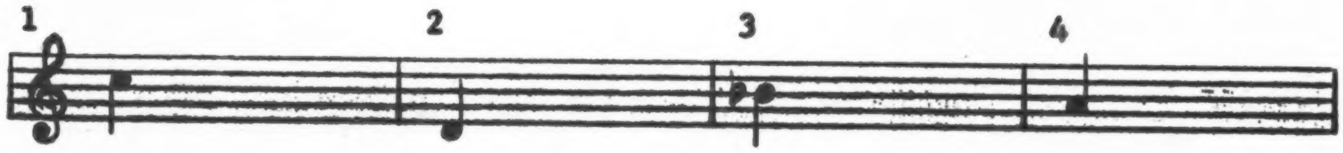

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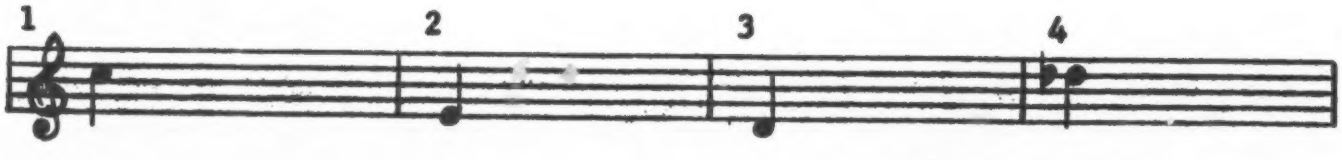
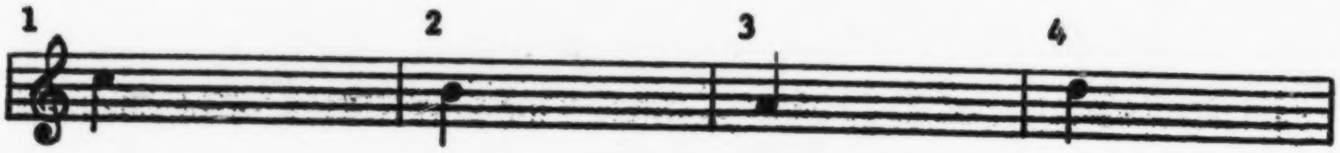


TGB$_2$

A



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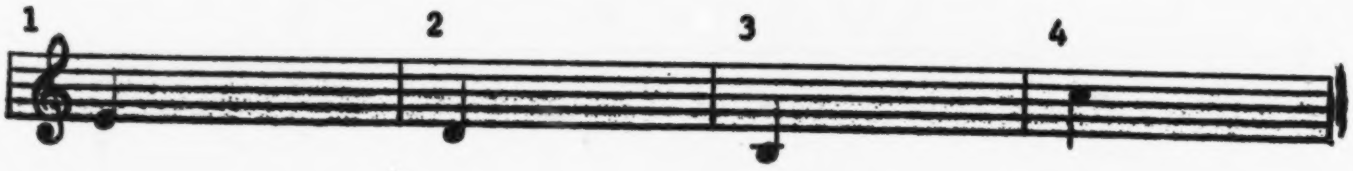

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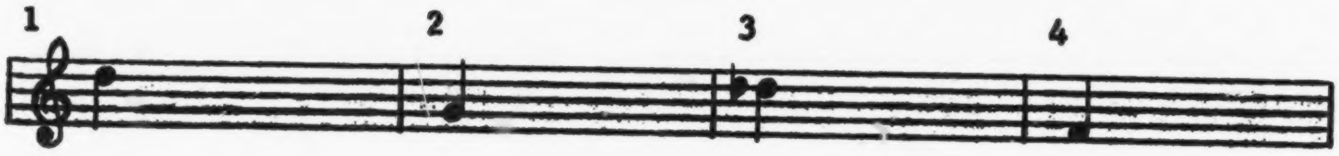

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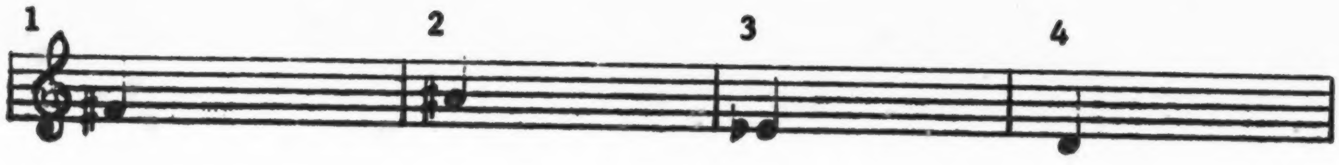

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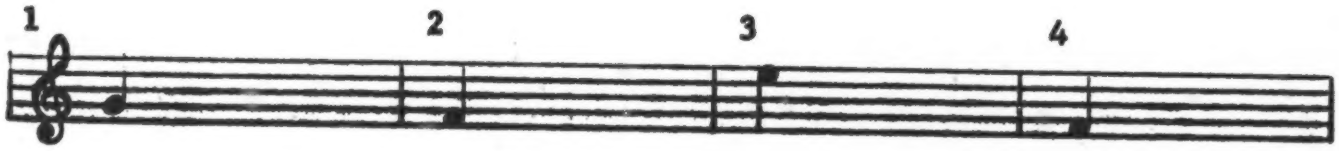

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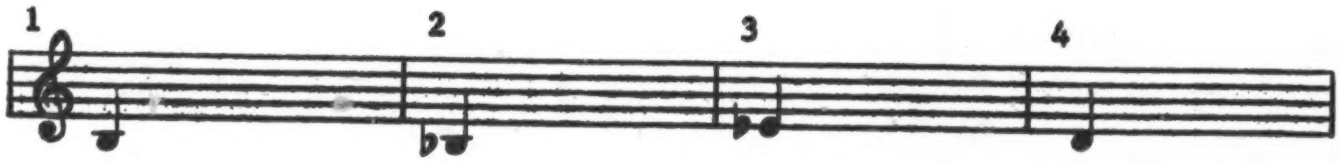
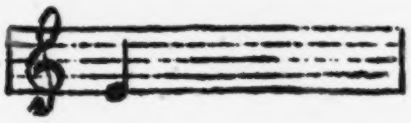


The tone groups in Part II of the test will be descending. Here is an example:



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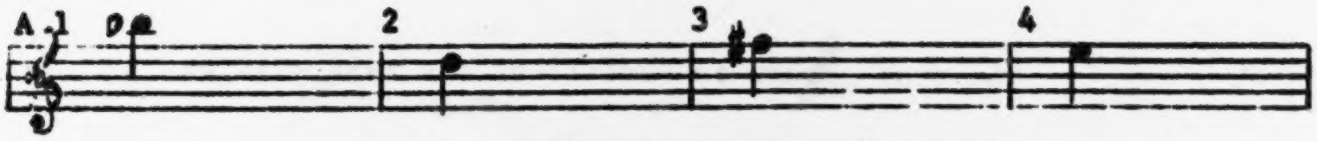

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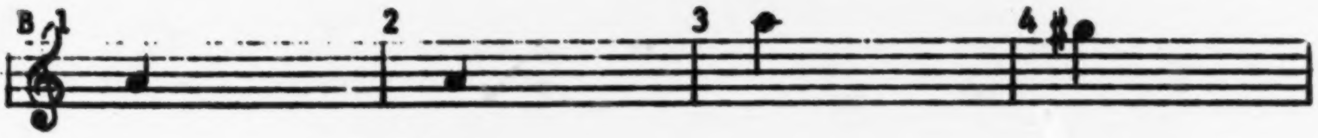

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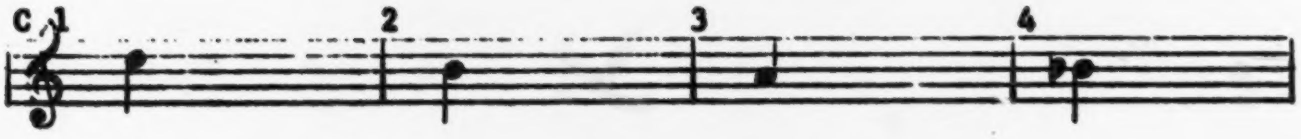

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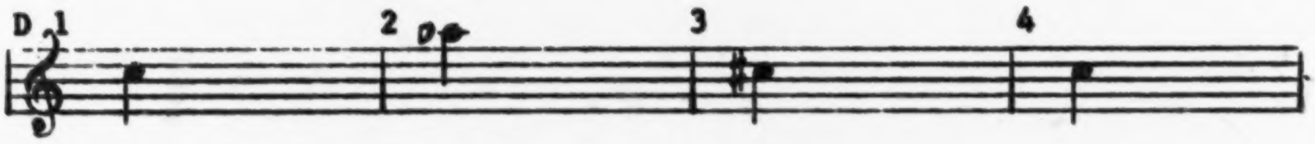

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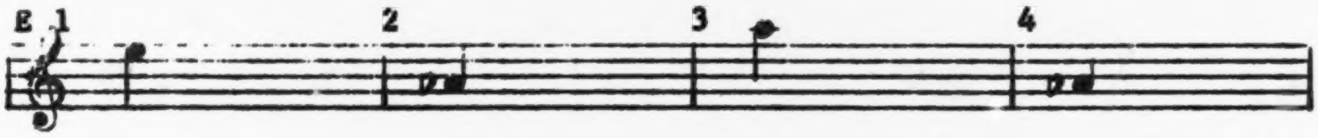

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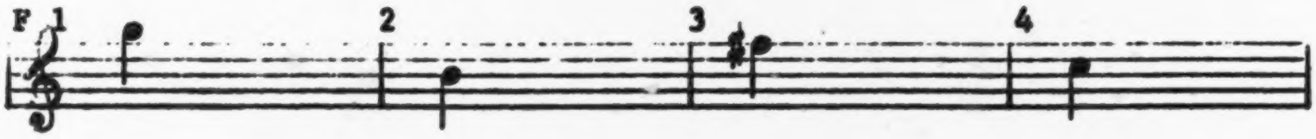

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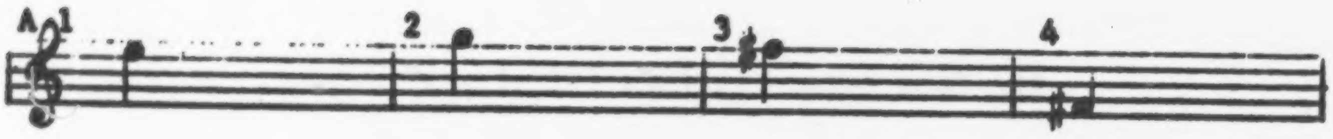
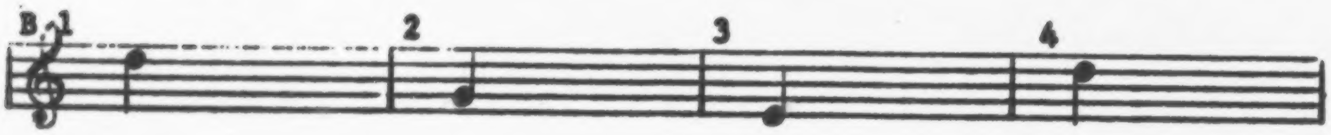


B


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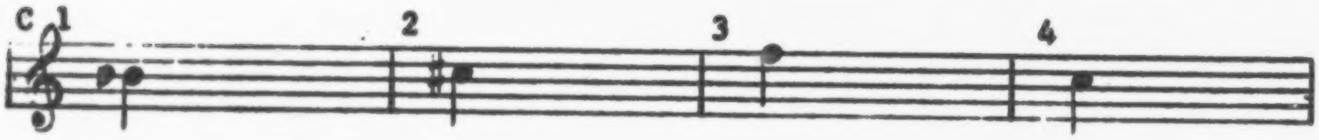

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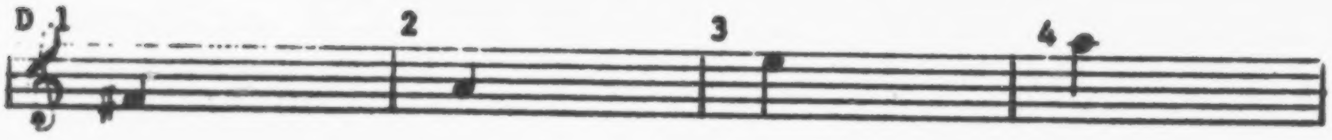

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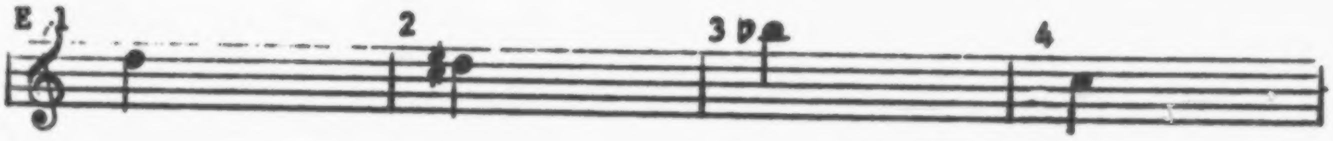

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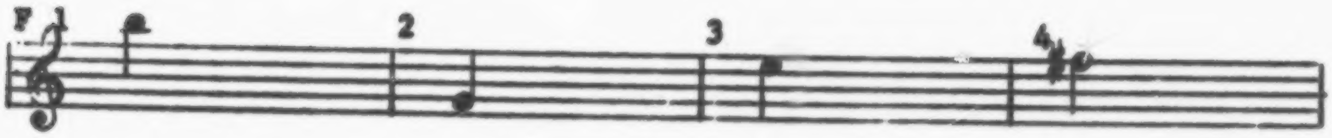
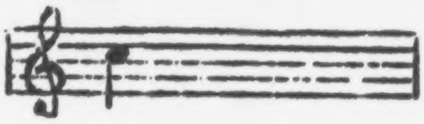
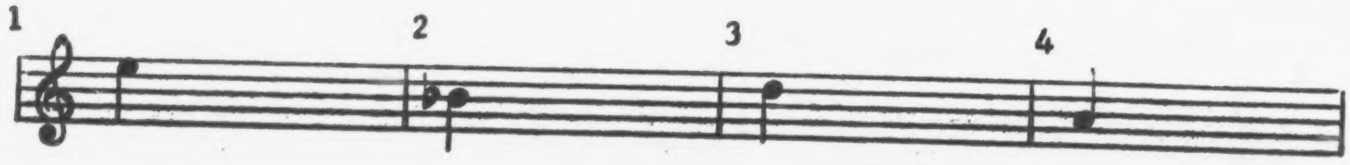


The tone groups in Part III of the test will be both ascending and descending. Here is an example:



TGD$_1$

A



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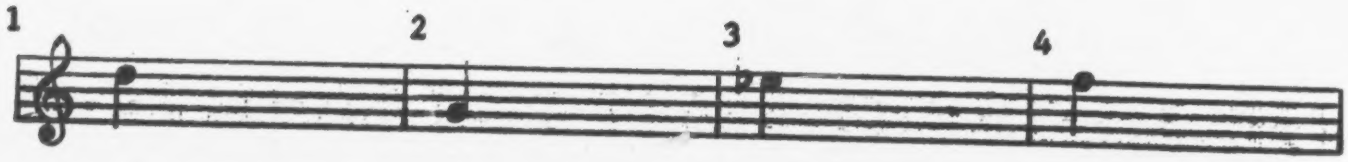

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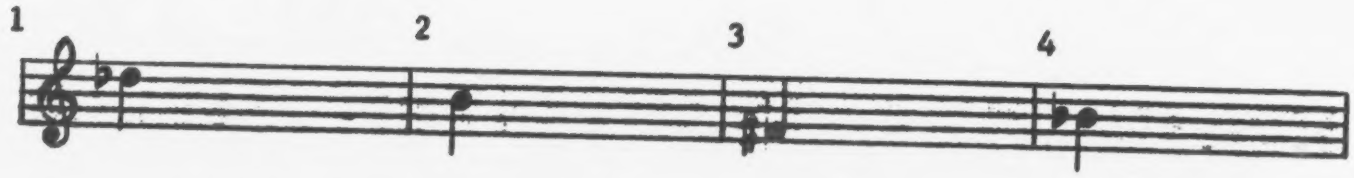

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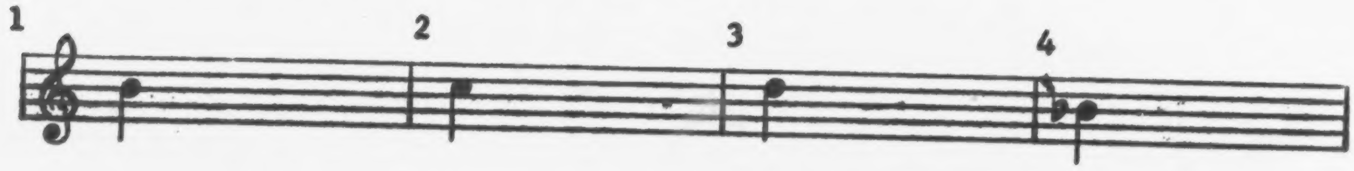

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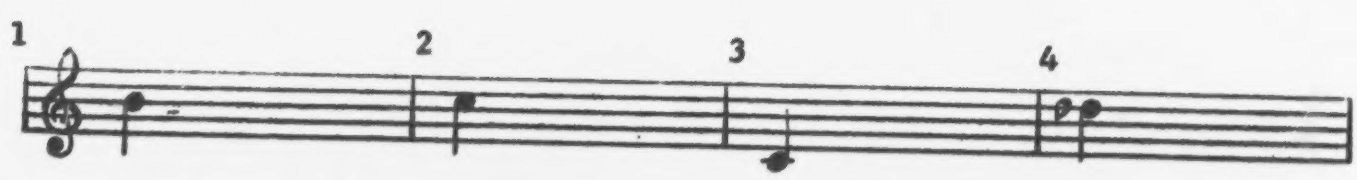

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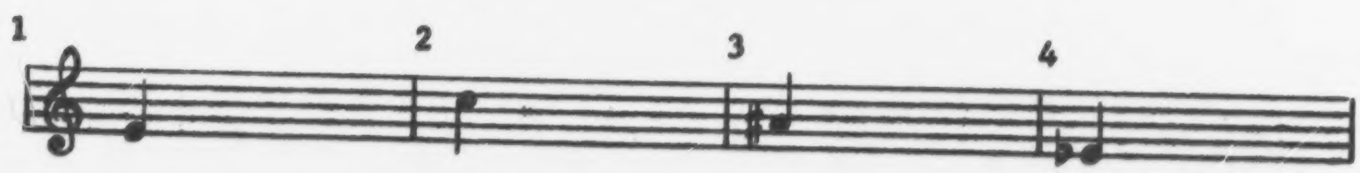
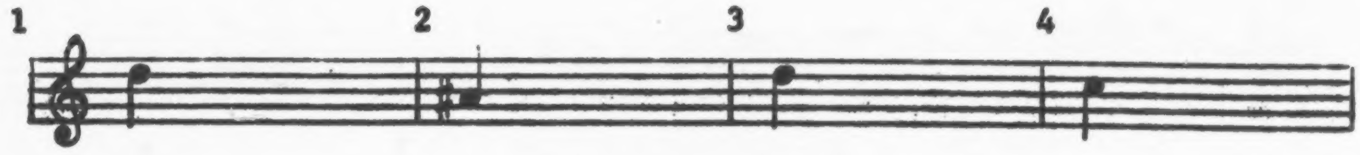


TGD$_2$

A



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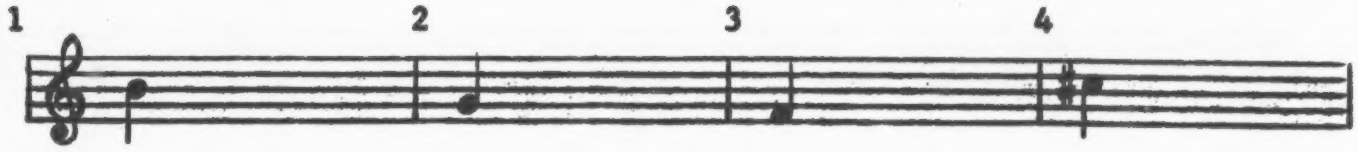

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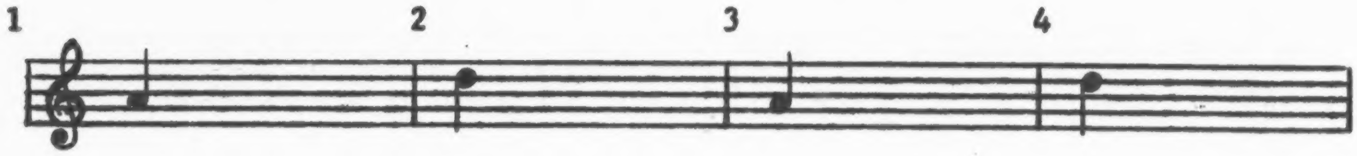

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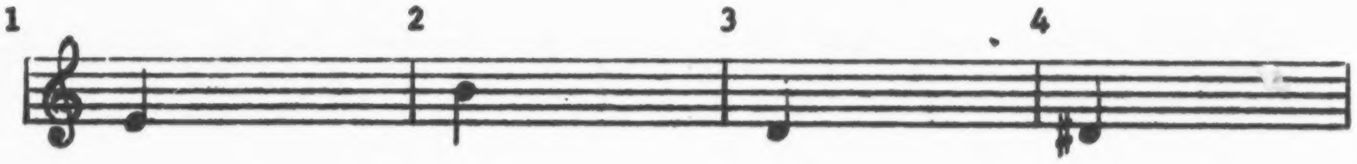

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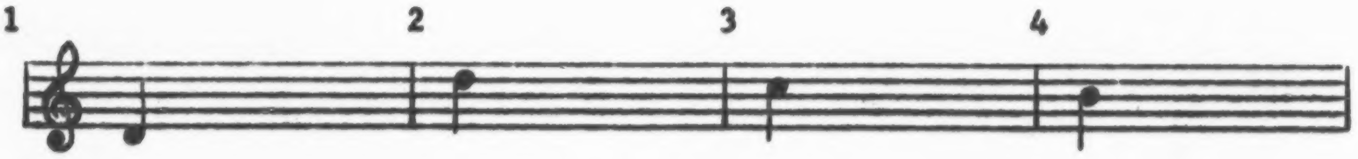

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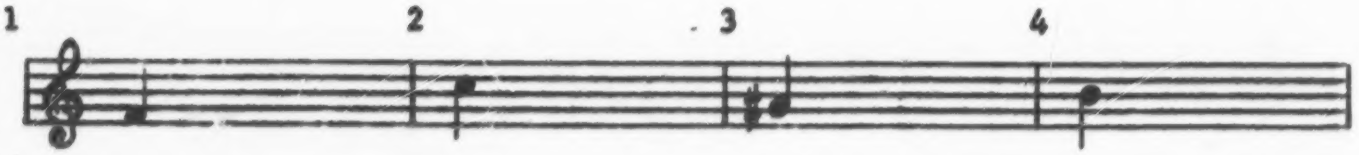
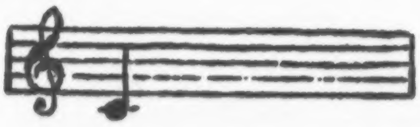


MELODIC TEST

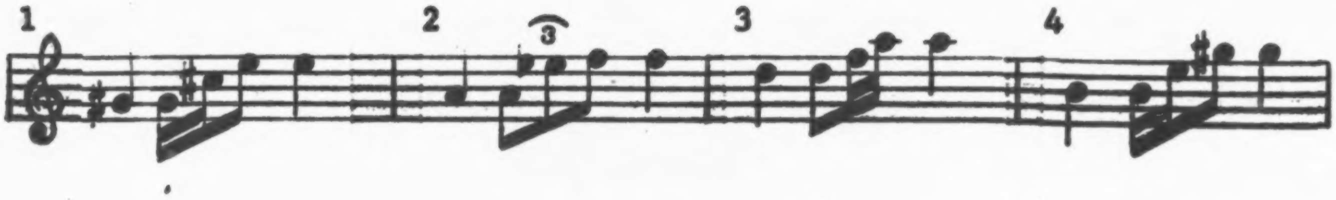
This is the first section of a three part test in which you are asked to identify three beat melodic groups (Tone Groups) presented in three different ways. In each part of the test you will see the first note for each tone group printed on the answer form. The tone groups will be played on the piano and you will be given ten metronome beats in which to write with notation the rhythm and pitches on the staff. In all parts of the test EACH tick of the metronome equals the EIGHTH-NOTE, therefore, there will be TWO TICKS PER QUARTER-NOTE value. The tone groups in Part I will be played in an ascending pattern.

Here is an example:



TGB$_1$

A



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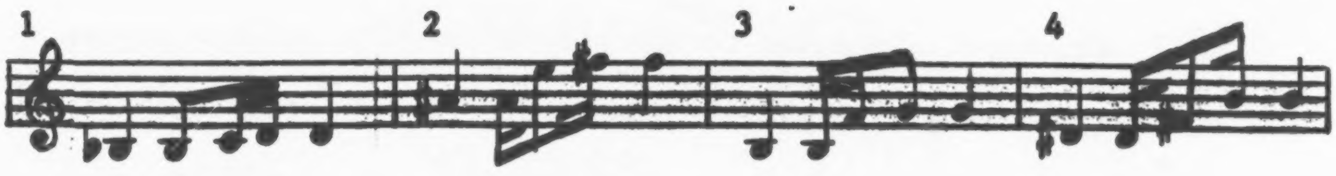

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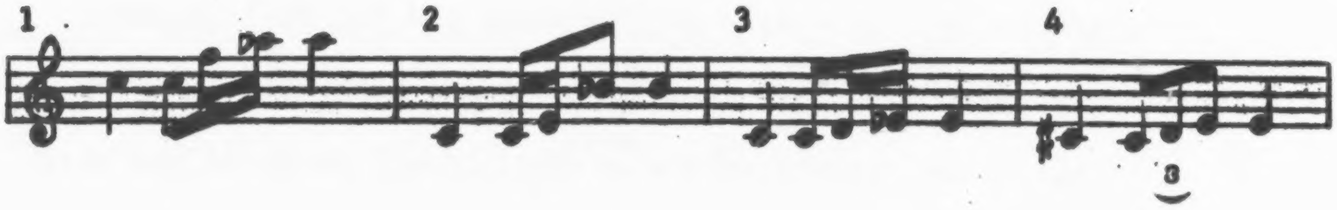
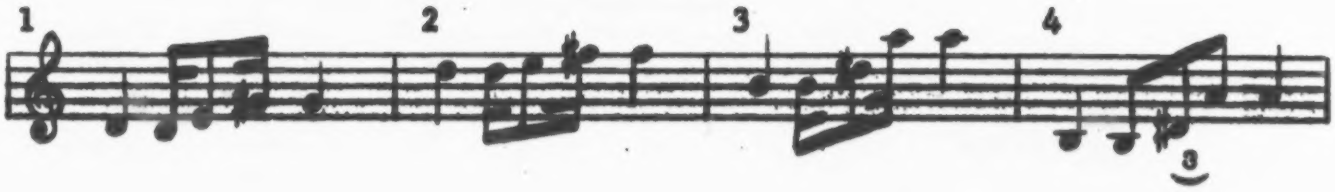


D



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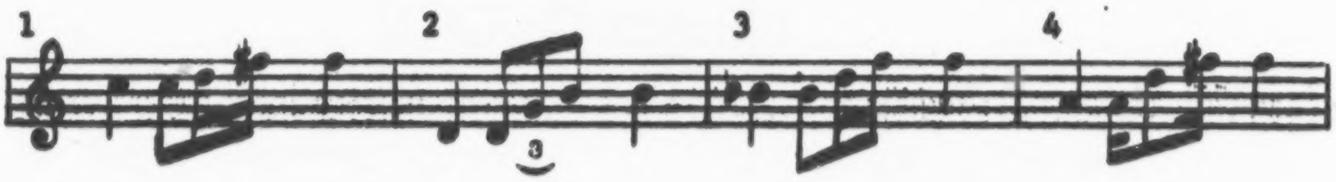

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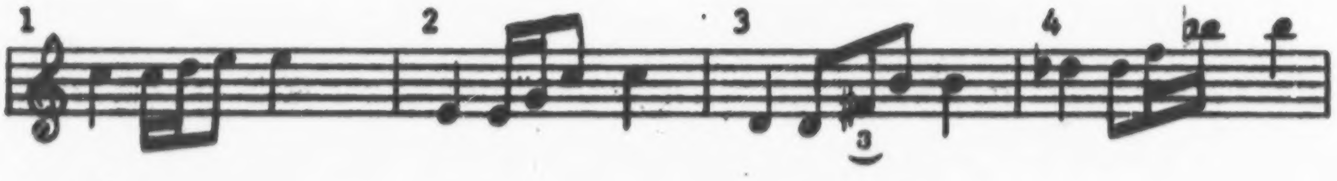
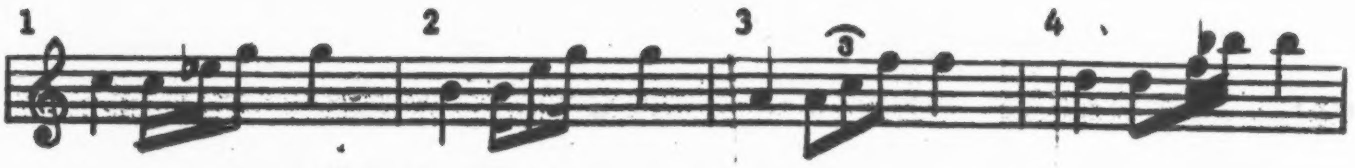


TGB$_2$

A



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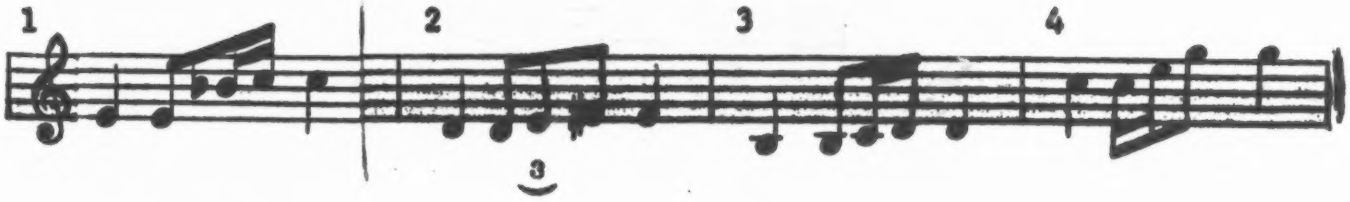

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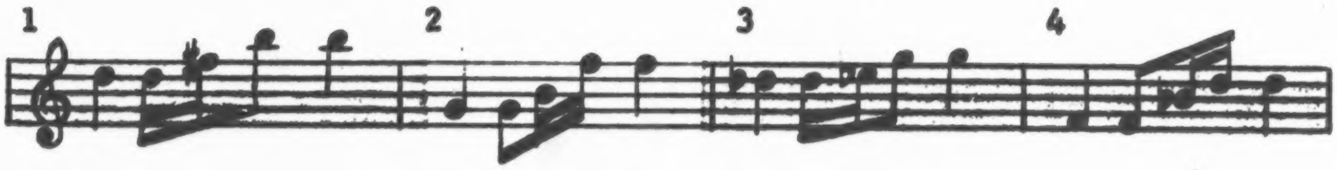

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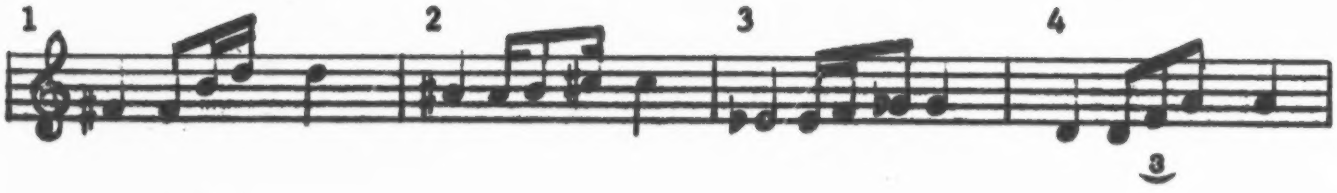

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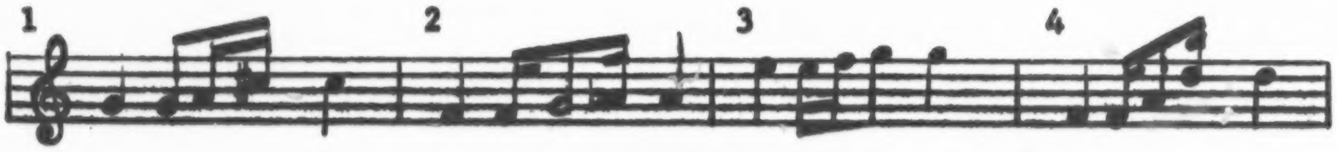

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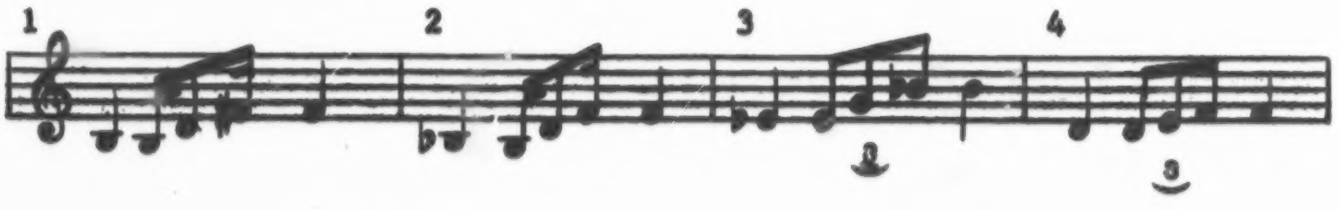
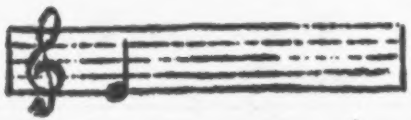
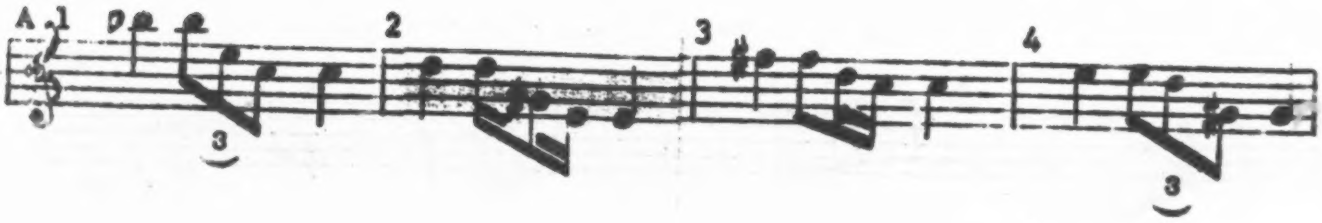
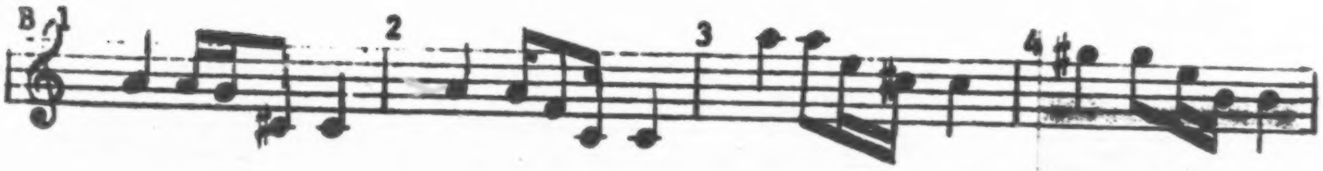


The tone groups in Part II of the test will be descending. Here is an example:



TGC$_1$

A


B


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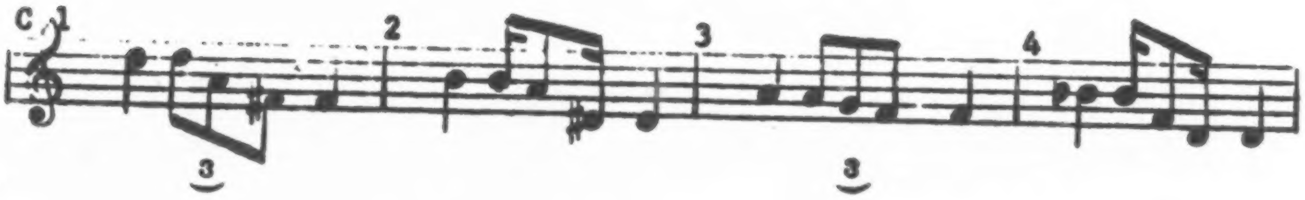
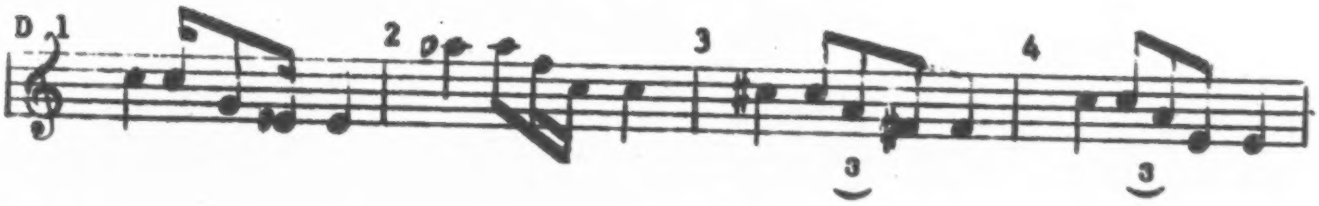


D


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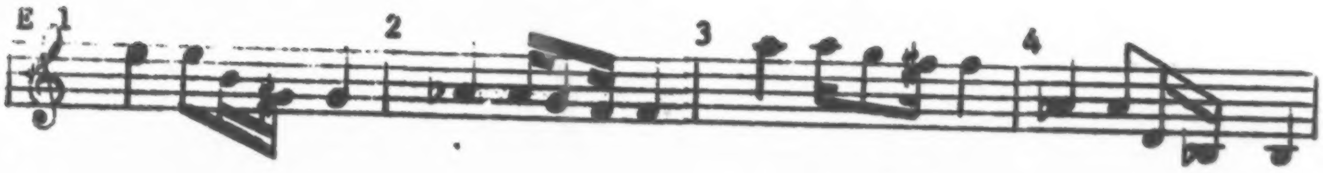

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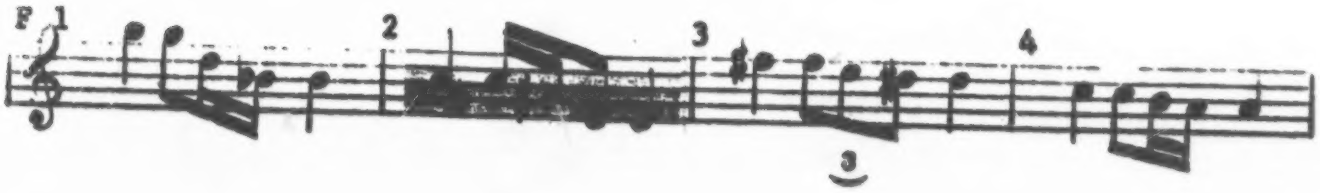
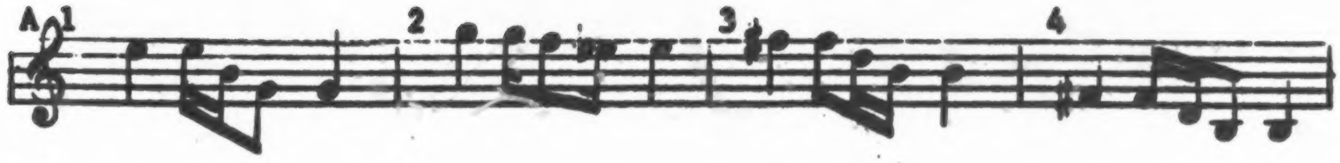


TGC$_2$

A


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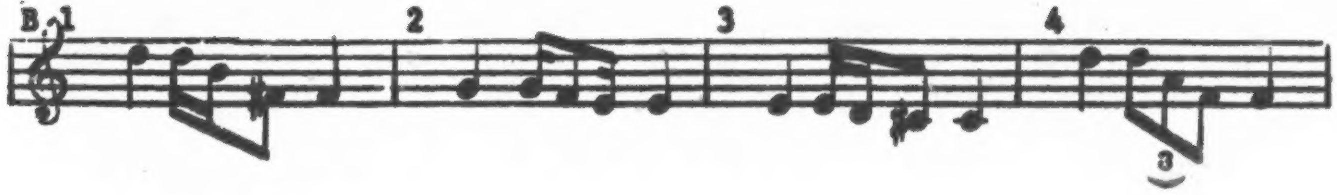

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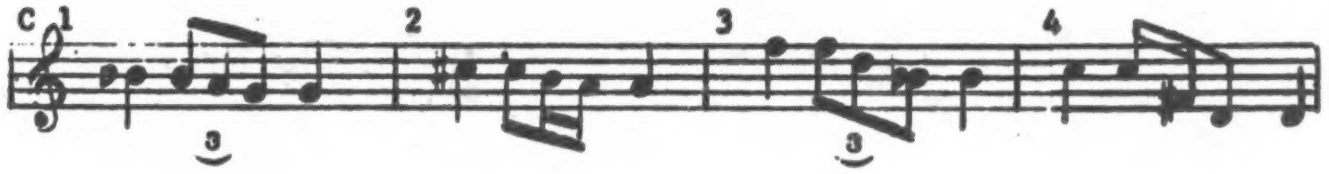

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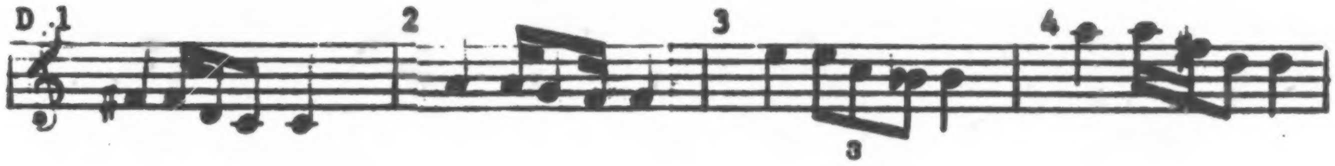

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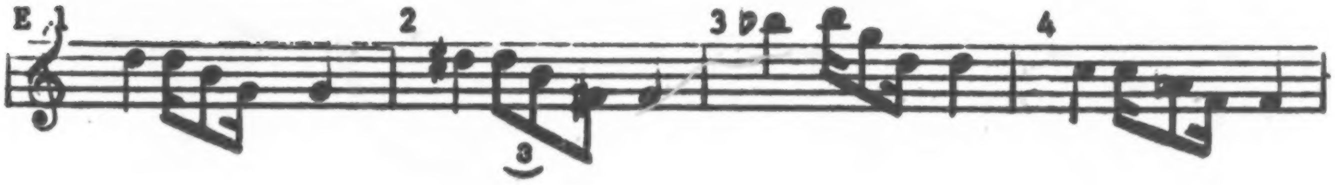

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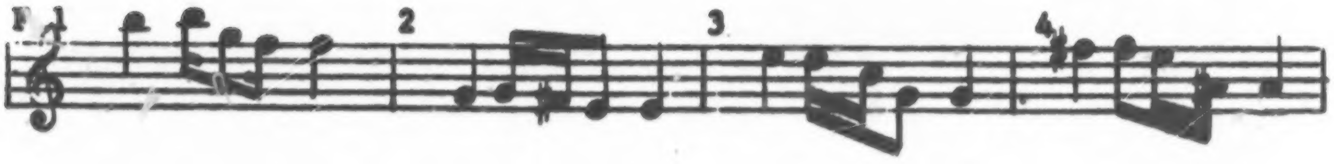
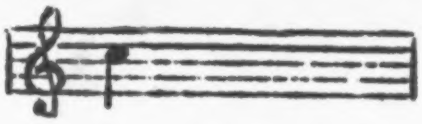
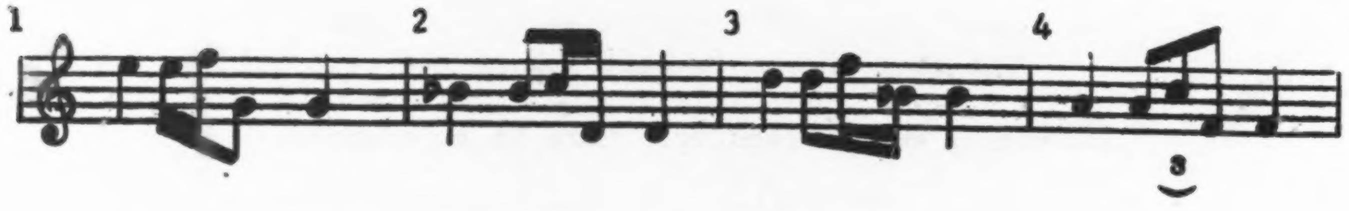


The tone groups in Part III of the test will be both ascending and descending. Here is an example:



TGD$_1$

A



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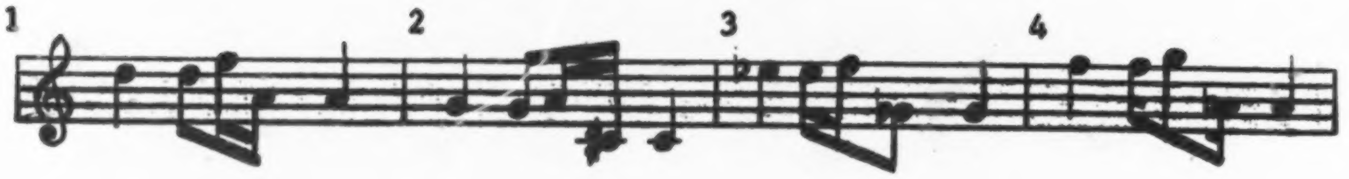

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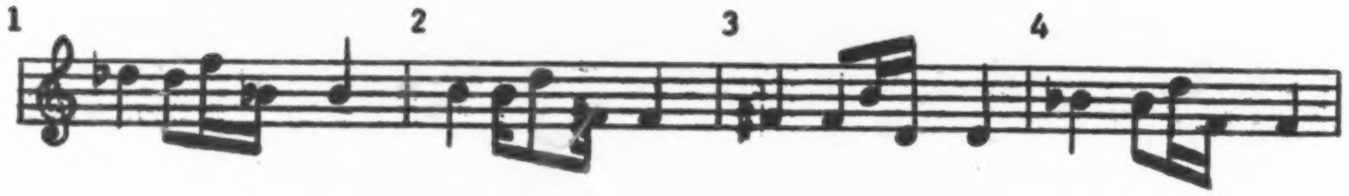

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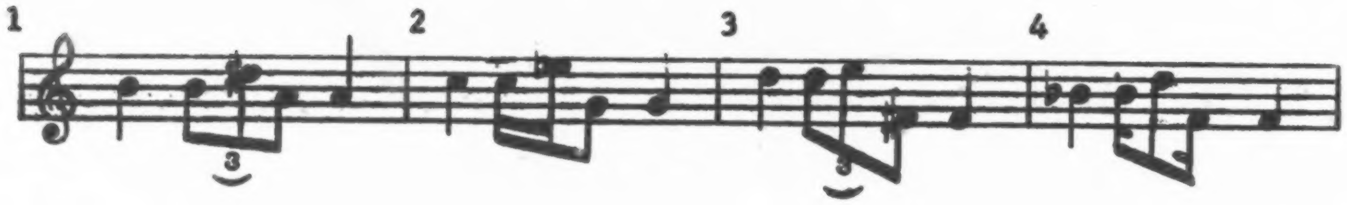

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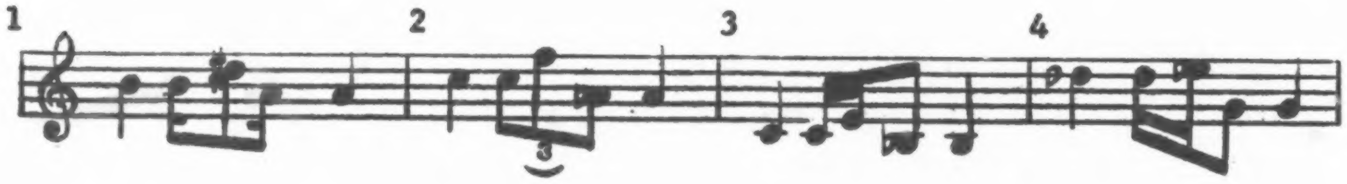

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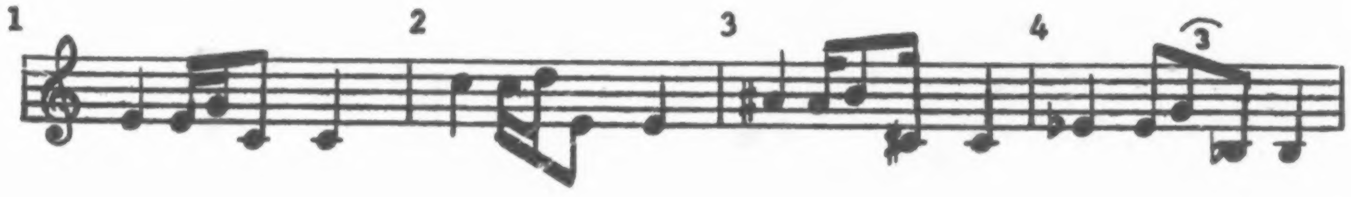
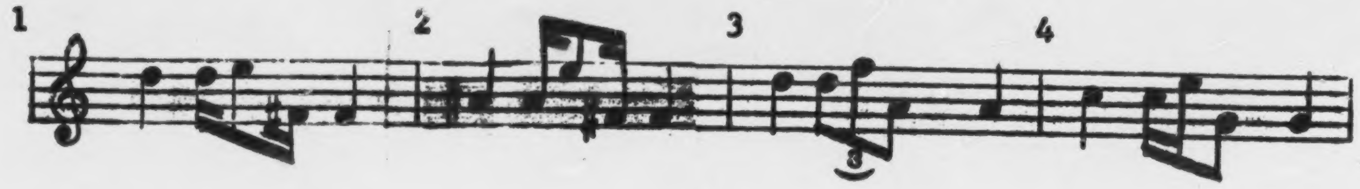


TGD$_2$

A



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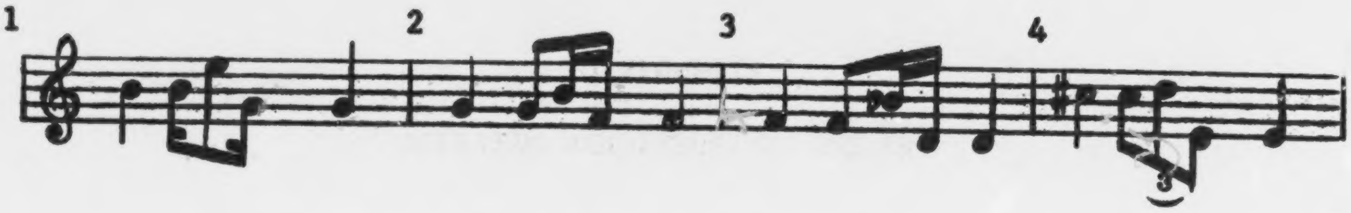

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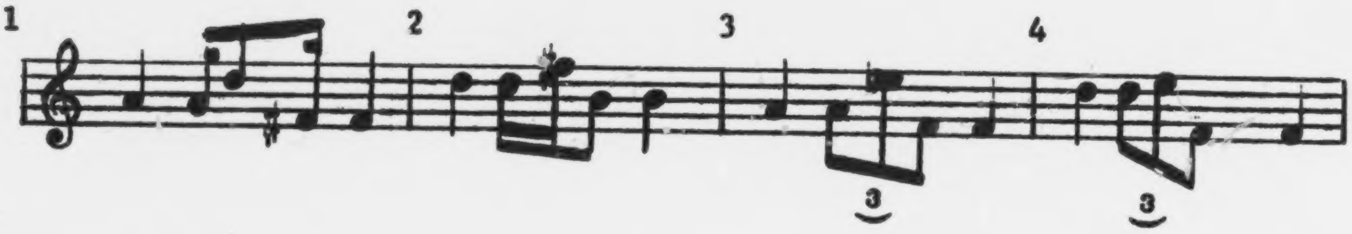

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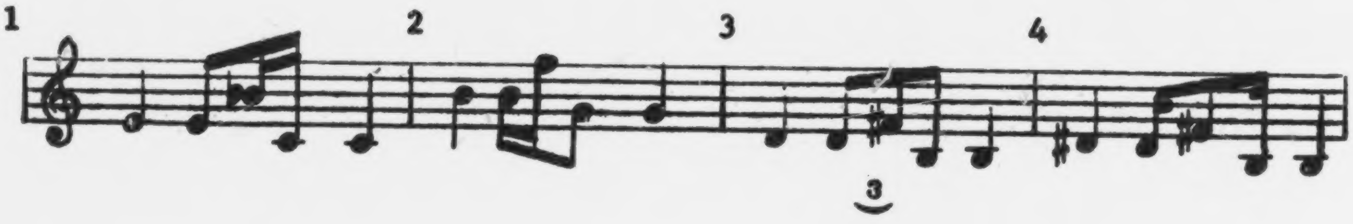

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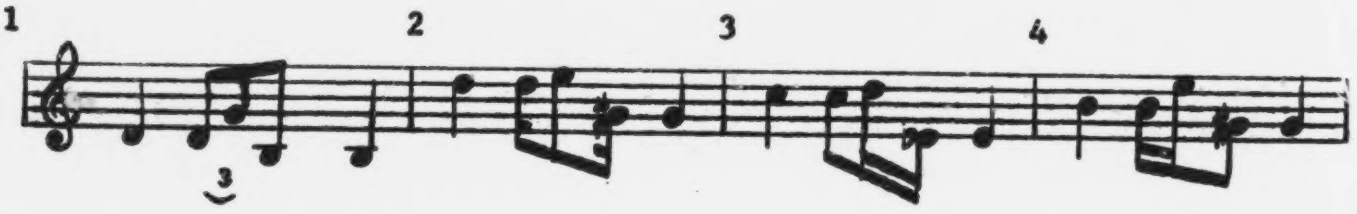

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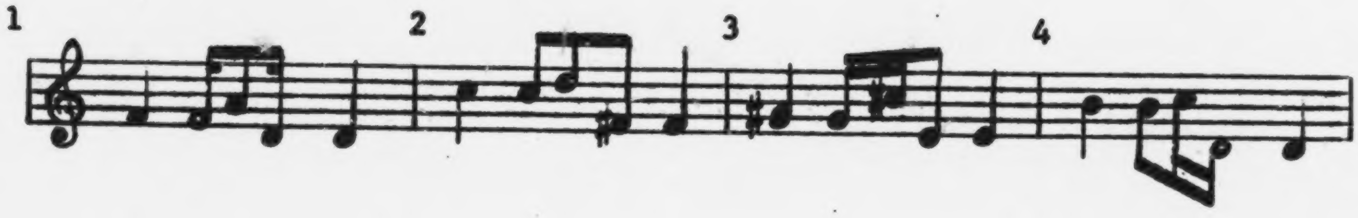


APPENDIX C

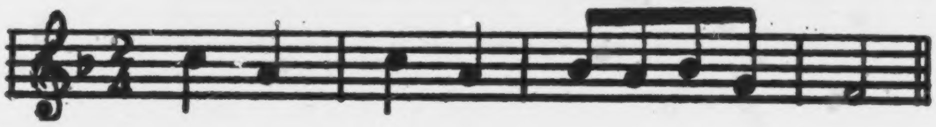
MELODY INSTRUCTIONAL MATERIAL

NAME________________________ TITLE MC 10

COURSE__________ INSTRUCTOR__________ DATE__________

In this exercise you will be asked to write melodies that will be played on the piano. These melodies will be played three times with enough time between each playing to write the melodies. You will first hear the tonic chord. The unit of beat will be given and the first beats of measures will be accented. The clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

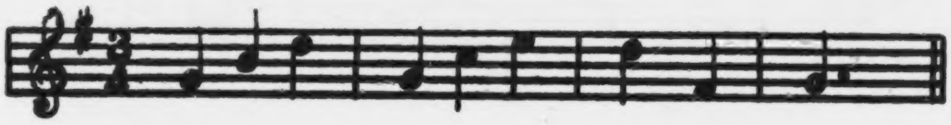
1.



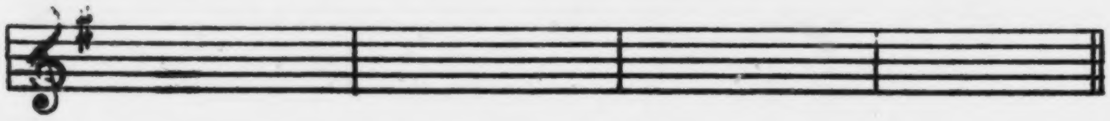
Check your answer.

Total No. of Errors
Melody 1.

2.



Check your answer.

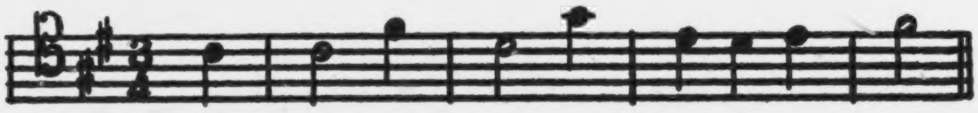


Total No. of Errors
Melody 2.

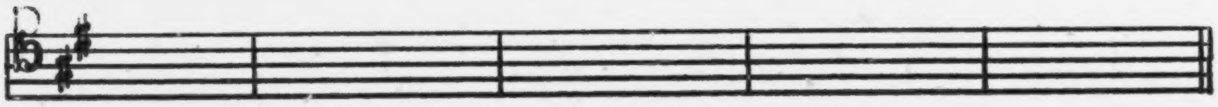
NAME________________________ TITLE MC 20

COURSE__________ INSTRUCTOR__________ DATE__________

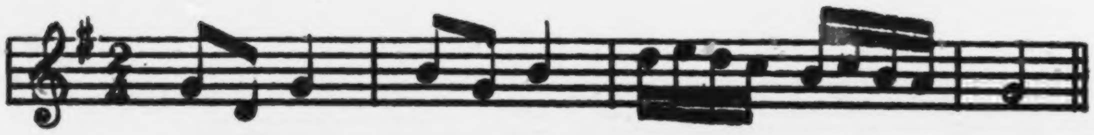
In this exercise you will be asked to write melodies that will be played on the piano. These melodies will be played three times with enough time between each playing to write the melodies. You will first hear the tonic chord. The unit of beat will be given and the first beats of measures will be accented. The clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1. 

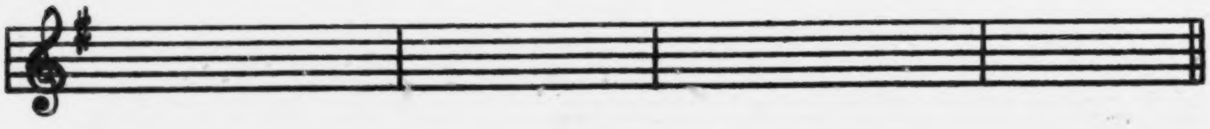
Check your answer.



Total No. of Errors
Melody 1. ☐

2. 

Check your answer.



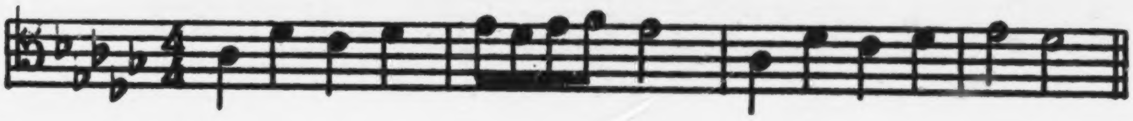
Total No. of Errors
Melody 2. ☐

NAME________________________________ TITLE MC 30

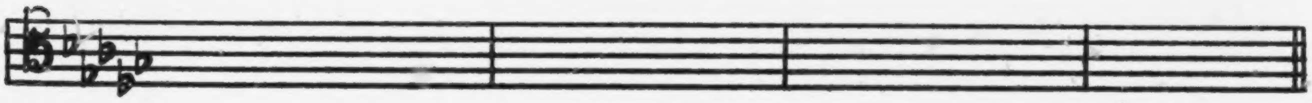
COURSE______________ INSTRUCTOR__________________ DATE__________________

In this exercise you will be asked to write melodies that will be played on the piano. These melodies will be played three times with enough time between each playing to write the melodies. You will first hear the tonic chord. The unit of beat will be given and the first beats of measures will be accented. The clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1.



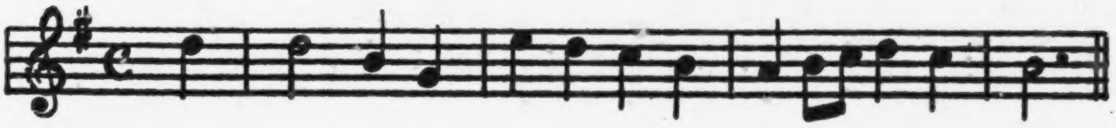
Check your answer.



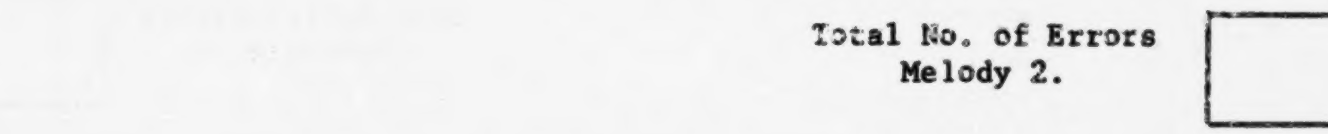
Total No. of Errors
Melody 1.

☐

2.



Check your answer.



Total No. of Errors
Melody 2.

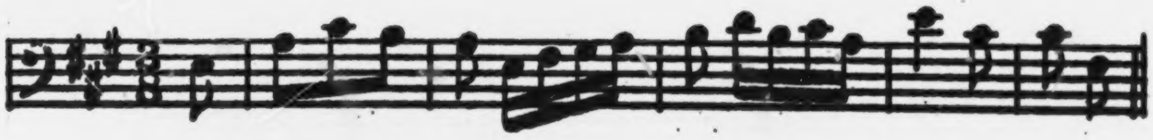
☐

NAME______________________________ TITLE MC 40__________

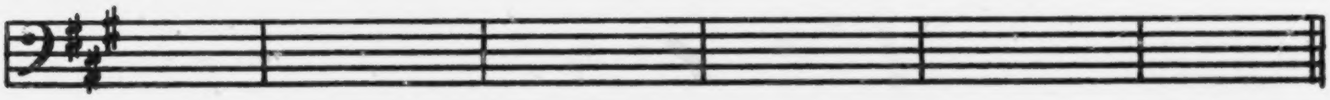
COURSE____________ INSTRUCTOR______________ DATE____________

In this exercise you will be asked to write melodies that will be played on the piano. These melodies will be played three times with enough time between each playing to write the melodies. You will first hear the tonic chord. The unit of beat will be given and the first beats of measures will be accented. The clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1.



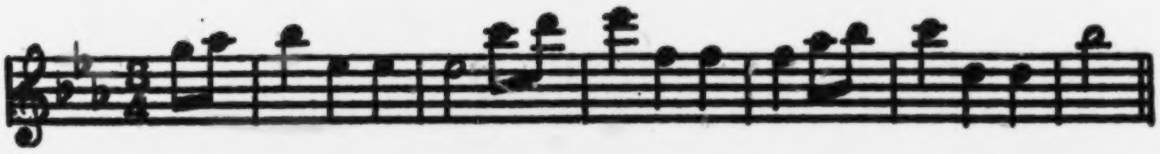
Check your answer.



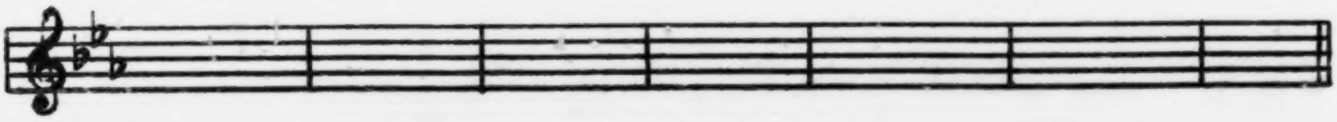
Total No. of Errors
Melody 1.

☐

2.



Check your answer.



Total No. of Errors
Melody 2.

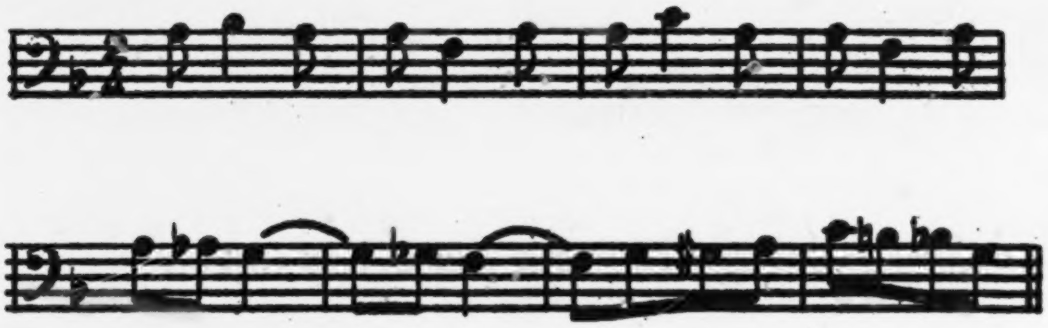
☐

NAME______________________________ TITLE MC 50

COURSE____________ INSTRUCTOR________________ DATE________________

In this exercise you will be asked to write melodies that will be played on the piano. These melodies will be played three times with enough time between each playing to write the melodies. You will first hear the tonic chord. The unit of beat will be given and the first beats of measures will be accented. The clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

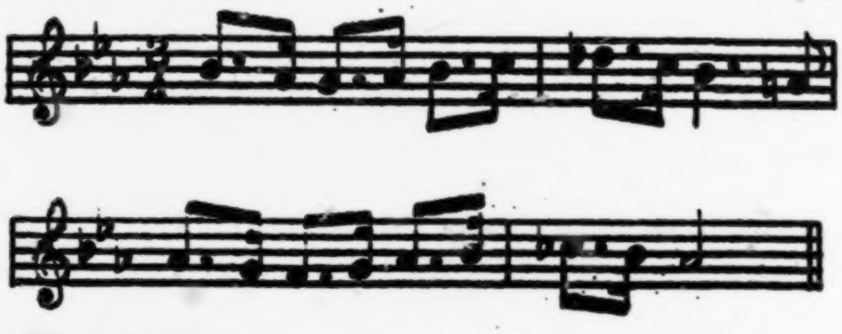
1.



Check your answer.

Total No. of Errors Melody 1. ☐

2.



Check your answer.

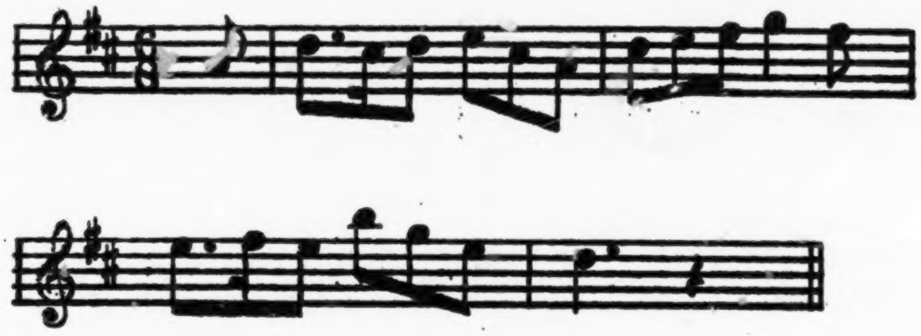
Total No. of Errors Melody 2. ☐

NAME______________________________ TITLE MC 60

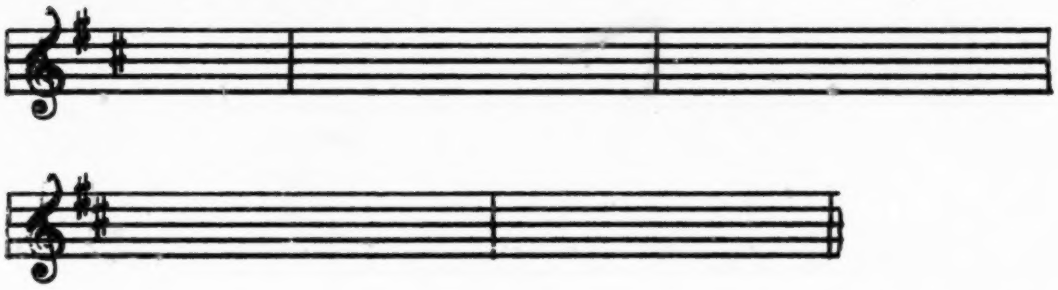
COURSE__________ INSTRUCTOR______________ DATE______________

In this exercise you will be asked to write melodies that will be played on the piano. These melodies will be played three times with enough time between each playing to write the melodies. You will first hear the tonic chord. The unit of beat will be given and the first beats of measures will be accented. The clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1.

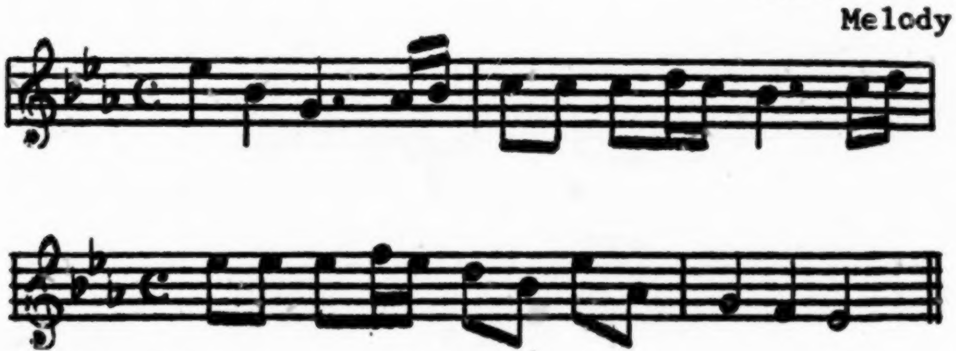


Check your answer.



Total No. of Errors
Melody 1. ☐

2.



Check your answer.

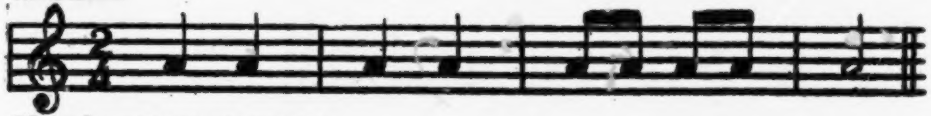
Total No. of Errors
Melody 2. ☐

NAME________________________________ TITLE MD 10

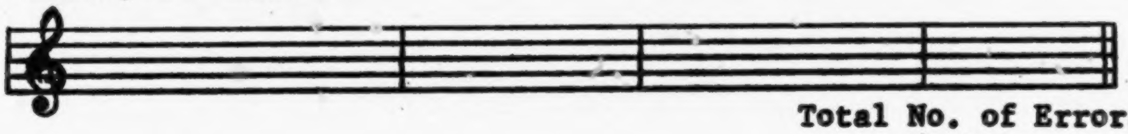
COURSE__________ INSTRUCTOR________________ DATE______________

In this exercise you will be asked to write rhythms and then intervals. Both of these items will be played twice. The unit of beat will be given for the rhythm with the first beat of each measure accented. Clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. The unit of beat for the intervals will be a quarter note (♩) and the tonic chord will be sounded before the first playing. If you wrote the rhythm and intervals correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff. For the rhythmic dictation notate the rhythm on the second space of the staff.

RHYTHM



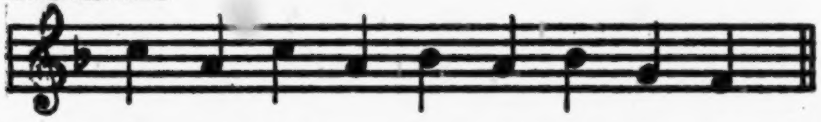
Check your answer.



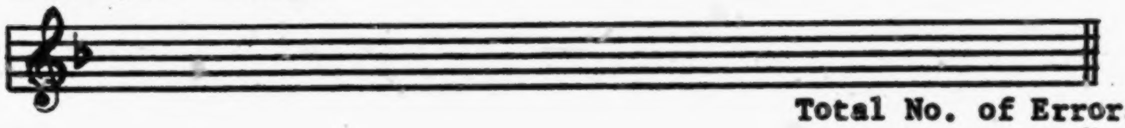
1.

Total No. of Errors
Rhythm 1.
☐

INTERVALS

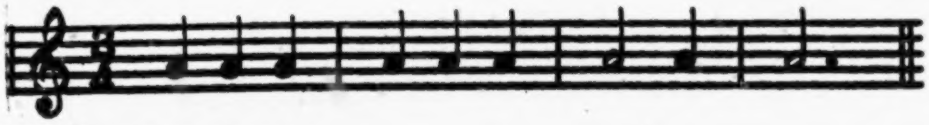


Check your answer.

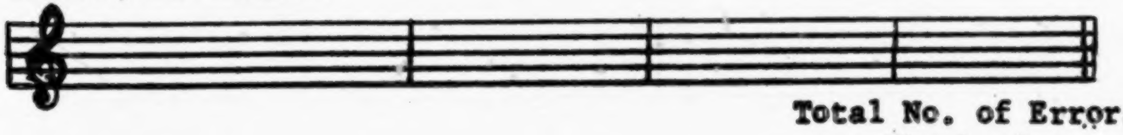


Total No. of Errors
Intervals 1.
☐

RHYTHM



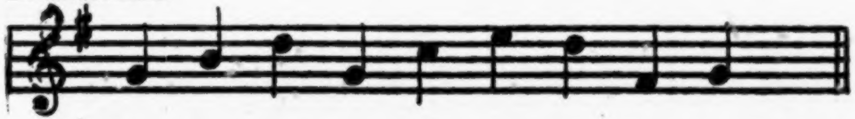
Check your answer.



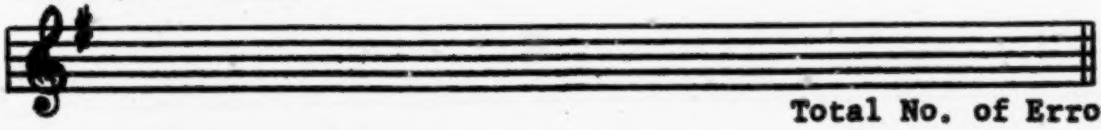
2.

Total No. of Errors
Rhythm 2.
☐

INTERVALS



Check your answer.



Total No. of Errors
Intervals 2.
☐

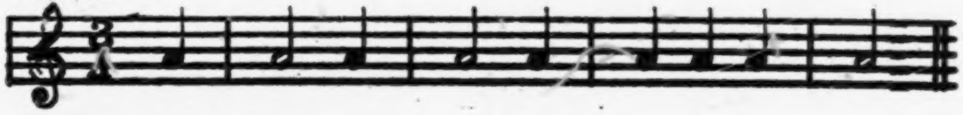
NAME______________________________ TITLE MD 20

COURSE__________ INSTRUCTOR__________________ DATE________________

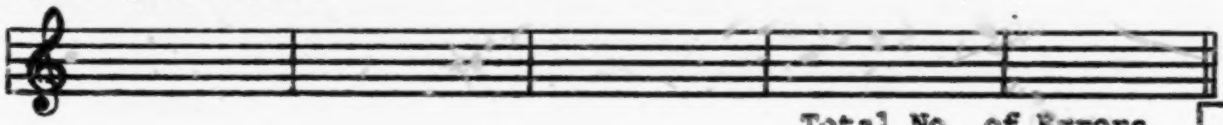
In this exercise you will be asked to write rhythms and intervals. Both of these items will be played twice. The unit of beat will be given for the rhythm with the first beat of each measure accented. Clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. For the rhythmic dictation notate the rhythm on the second space of the staff. The unit of beat for the intervals will be a quarter note (♩) and the tonic chord will be sounded before the first playing. If you wrote the rhythm and intervals correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1.

RHYTHM

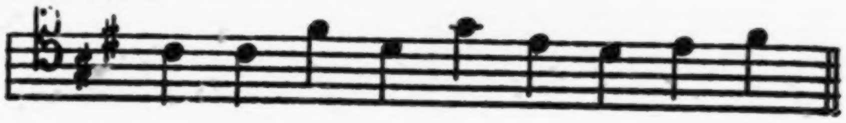


Check your answer.



Total No. of Errors
Rhythm 1.

INTERVALS

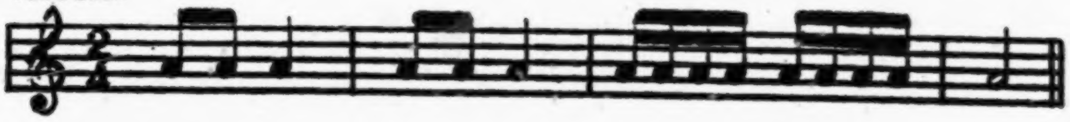


Check your answer.

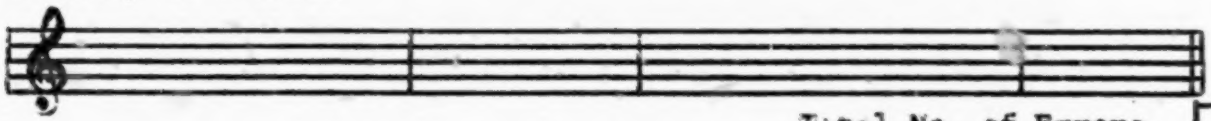
Total No. of Errors
Intervals 1.

2.

RHYTHM

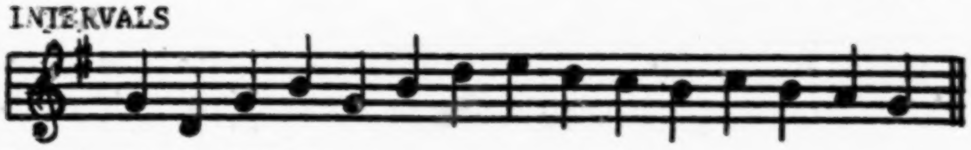


Check your answer.

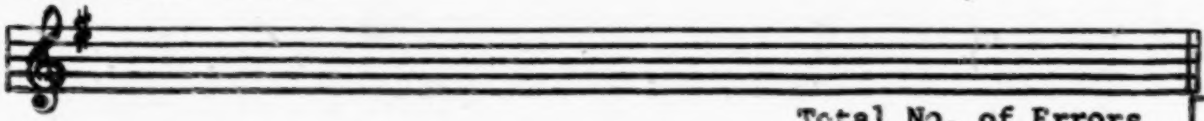


Total No. of Errors
Rhythm 2.

INTERVALS



Check your answer.



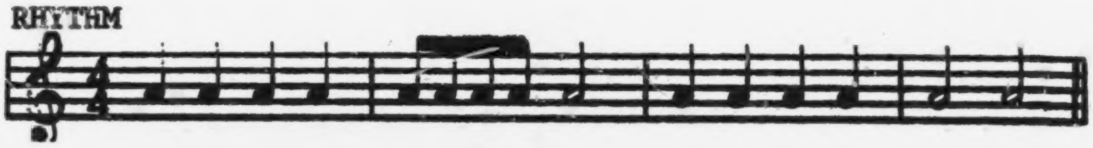
Total No. of Errors
Intervals 2.

NAME________________________________ TITLE MD 30

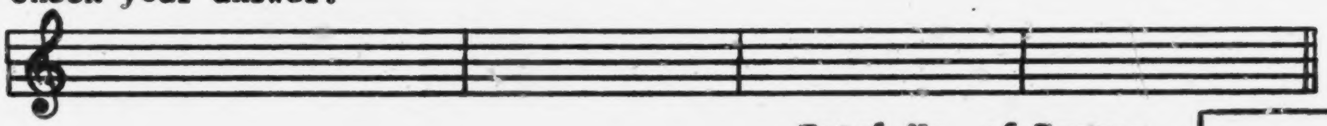
COURSE__________ INSTRUCTOR__________________ DATE__________________

In this exercise you will be asked to write rhythms and intervals. Both of these items will be played twice. The unit of beat will be given for the rhythm with the first beat of each measure accented. Clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. For the rhythmic dictation notate the rhythm on the second space of the staff. The unit of beat for the intervals will be a quarter note (♩) and the tonic chord will be sounded before the first playing. If you wrote the rhythm and intervals correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

RHYTHM



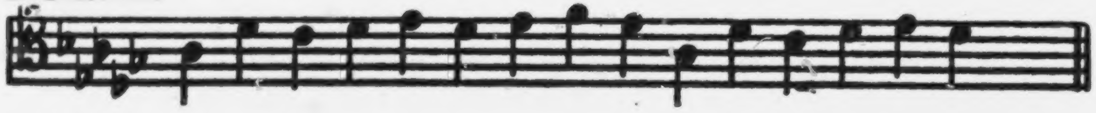
Check your answer.



1.

Total No. of Errors
Rhythm 1. ☐

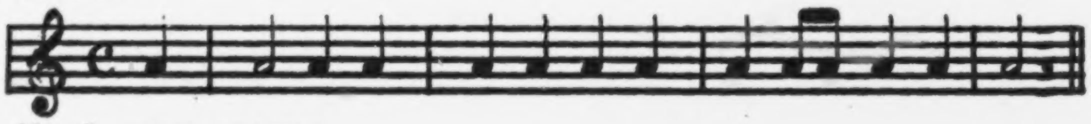
INTERVALS



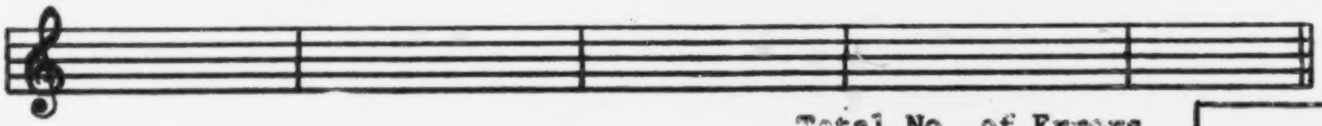
Check your answer.

Total No. of Errors
Intervals 1. ☐

RHYTHM



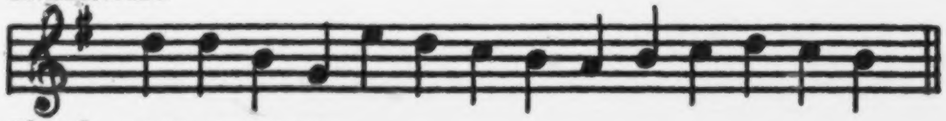
Check your answer.



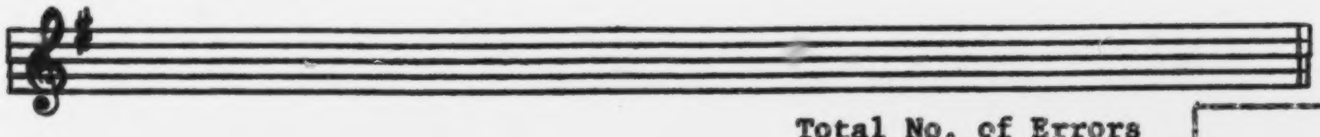
2.

Total No. of Errors
Rhythm 2. ☐

INTERVALS



Check your answer.



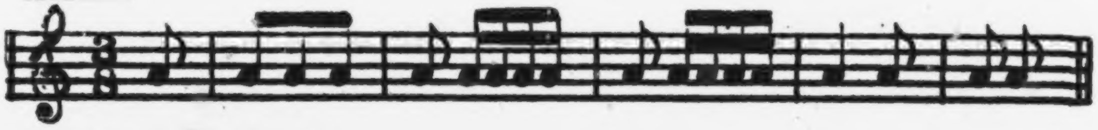
Total No. of Errors
Intervals 2. ☐

NAME________________________________ TITLE MD 40

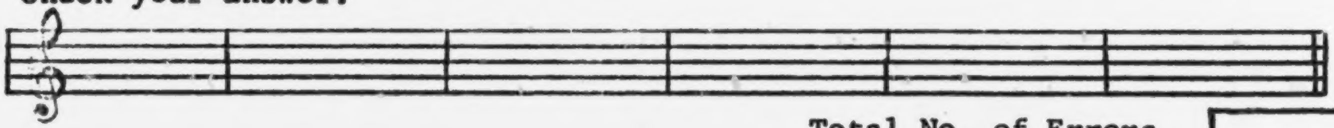
COURSE__________ INSTRUCTOR__________________ DATE______________

In this exercise you will be asked to write rhythms and intervals. Both of these items will be played twice. The unit of beat will be given for the rhythm with the first beat of each measure accented. Clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. For the rhythmic dictation notate the rhythm on the second space of the staff. The unit of beat for the intervals will be a quarter note (♩) and the tonic chord will be sounded before the first playing. If you wrote the rhythm and intervals correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

RHYTHM



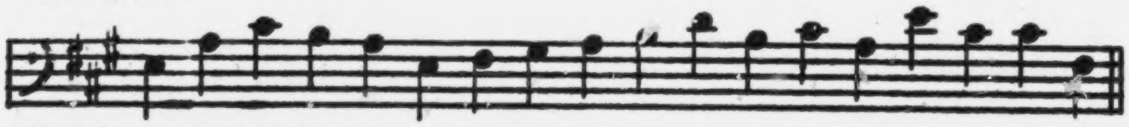
Check your answer.



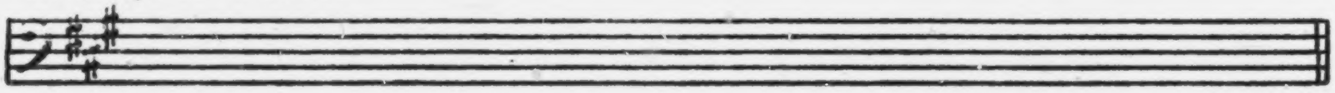
1.

Total No. of Errors
Rhythm 1.

INTERVALS

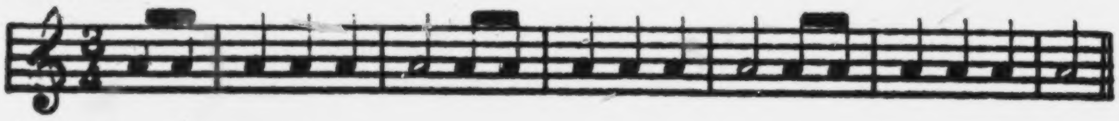


Check your answer.

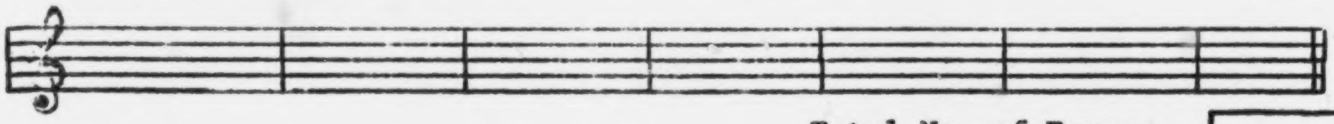


Total No. of Errors
Intervals 1.

RHYTHM



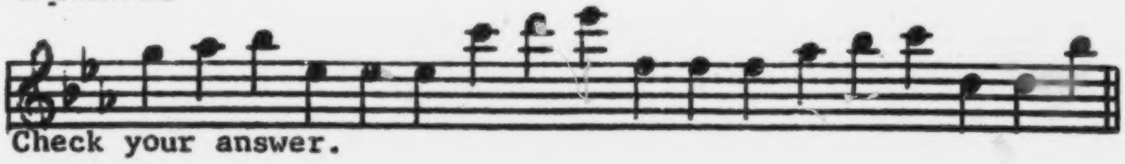
Check your answer.



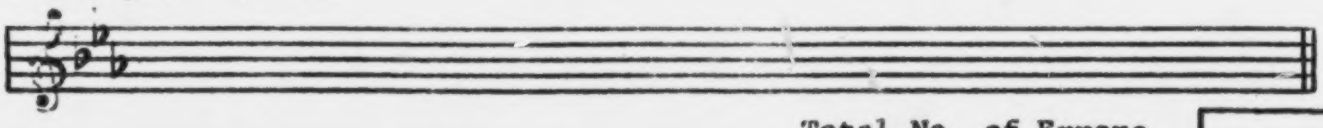
2.

Total No. of Errors
Rhythm 2.

INTERVALS



Check your answer.



Total No. of Errors
Intervals 2.

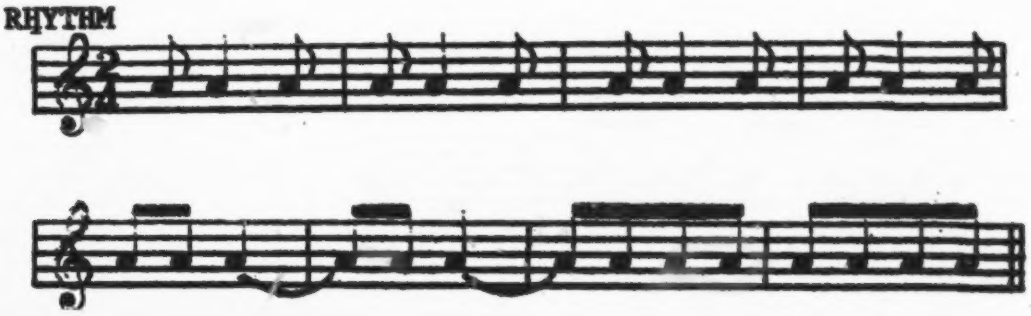
NAME____ TITLE MD 50

COURSE____________ INSTRUCTOR____________________ DATE__________________

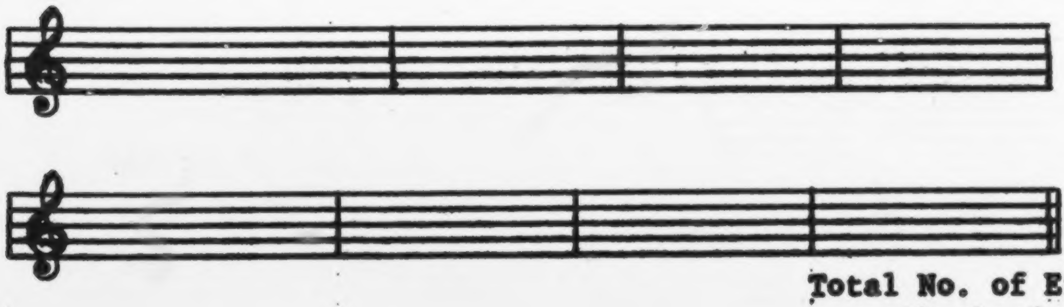
In this exercise you will be asked to write rhythms and intervals. Both of these items will be played twice. The unit of beat will be given for the rhythm with the first beat of each measure accented. Clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. For the rhythmic dictation notate the rhythm on the second space of the staff. The unit of beat for the intervals will be a quarter note (♩) and the tonic chord will be sounded before the first playing. If you wrote the rhythm and intervals correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

RHYTHM

1.



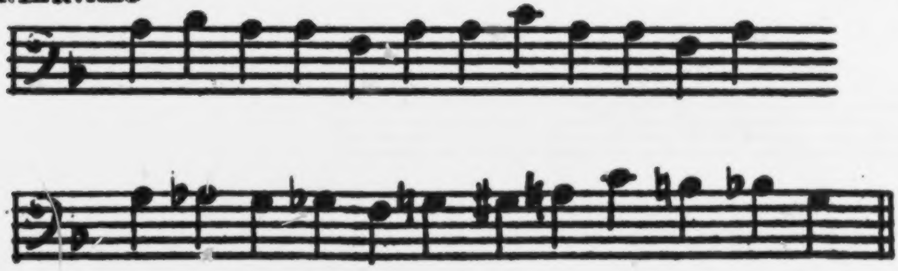
Check your answer.



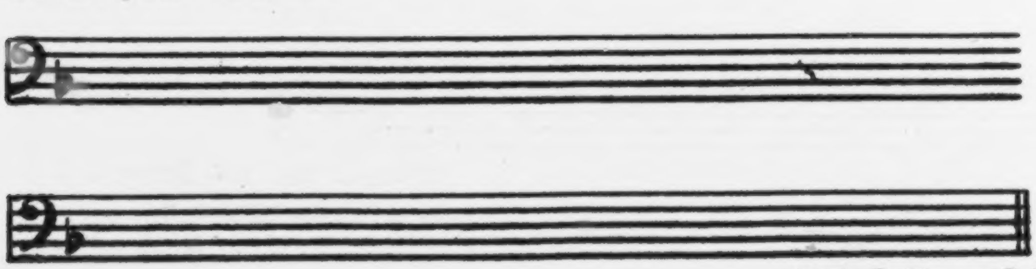
Total No. of Errors
Rhythm 1.

INTERVALS

1.



Check your answer.



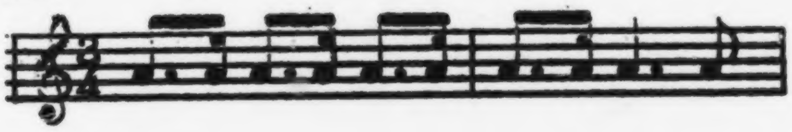
Total No. of Errors
Intervals 1.

Page 2 of two pages for Exercise MD 50

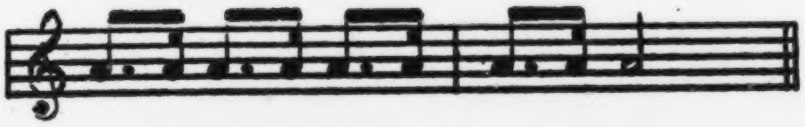
NAME______________________ COURSE______________

INSTRUCTOR______________________ DATE______________

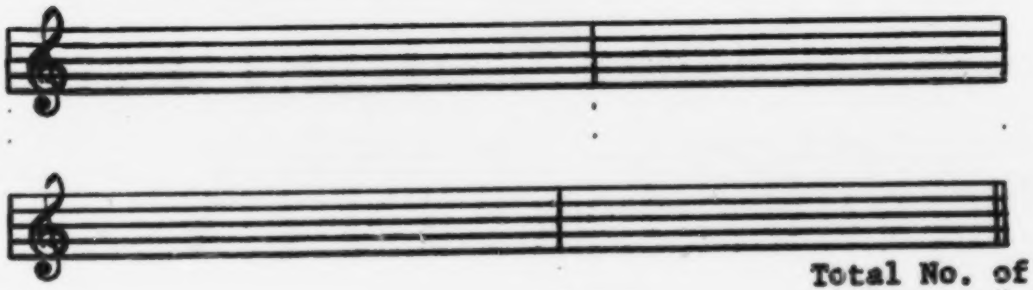
RHYTHM



2.



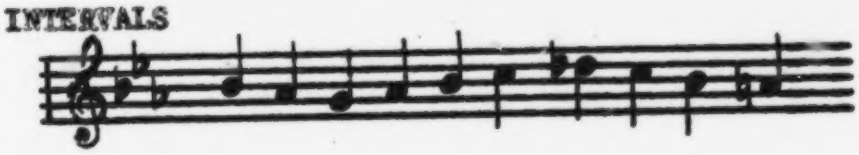
Check your answer.



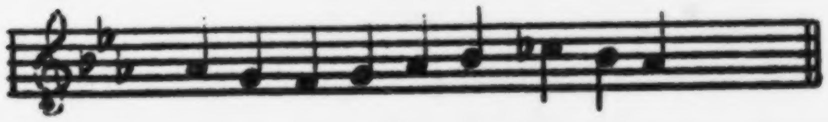
Total No. of Errors
Rhythm 2.

☐

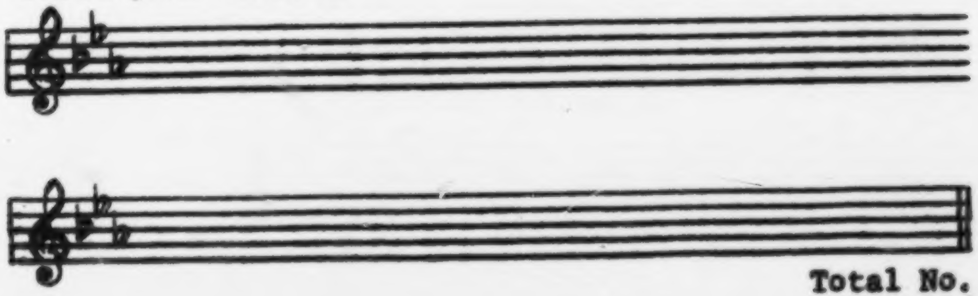
INTERVALS



2.



Check your answer.



Total No. of Errors
Intervals 2.

☐

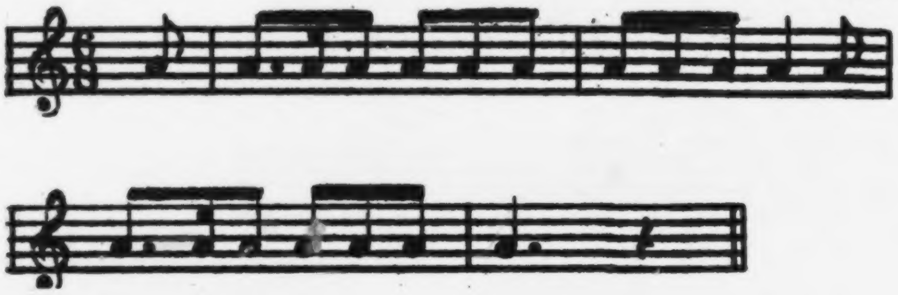
NAME________________________________ TITLE MD 60

COURSE____________ INSTRUCTOR__________________ DATE________________

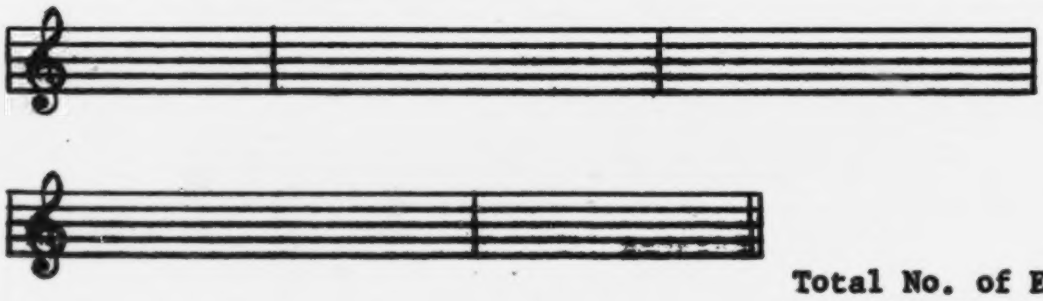
In this exercise you will be asked to write rhythms and intervals. Both of these items will be played twice. The unit of beat will be given for the rhythm with the first beat of each measure accented. Clef and key signatures are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff. For the rhythmic dictation notate the rhythm on the second space of the staff. The unit of beat for the intervals will be a quarter note (♩) and the tonic chord will be sounded before the first playing. If you wrote the rhythm and intervals correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

RHYTHM

1.



Check your answer.

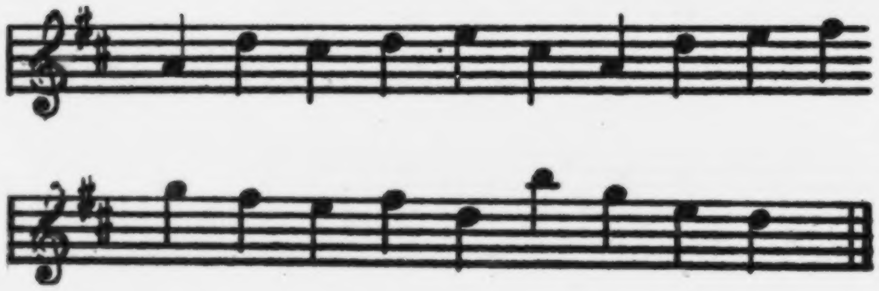


Total No. of Errors
Rhythm 1.

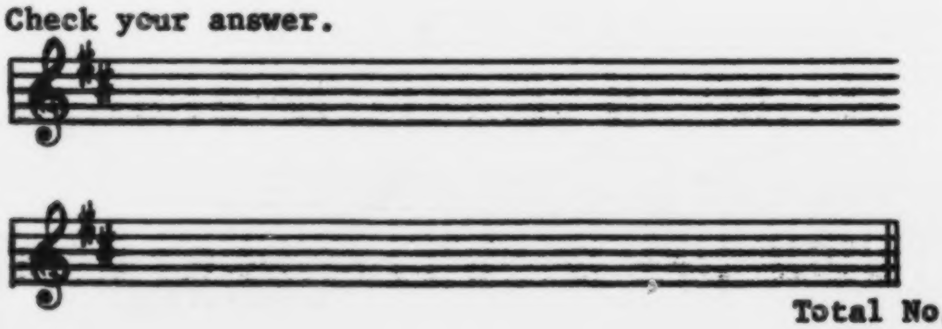
☐

INTERVALS

1.



Check your answer.



Total No. of Errors
Intervals 1.

☐

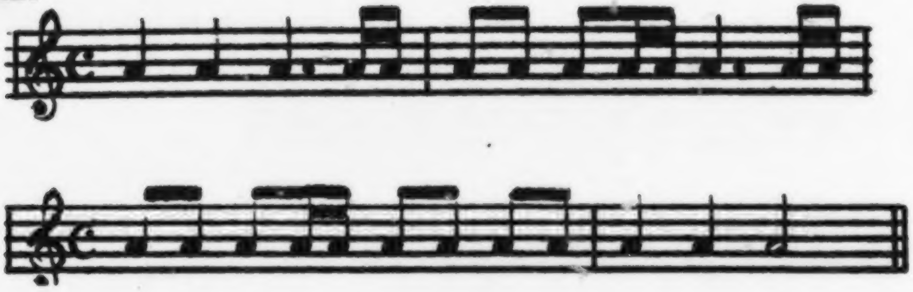
Page 2 of two pages for Exercise MD 60

NAME______________________________ COURSE________________

INSTRUCTOR__________________________ DATE________________

RHYTHM

2.

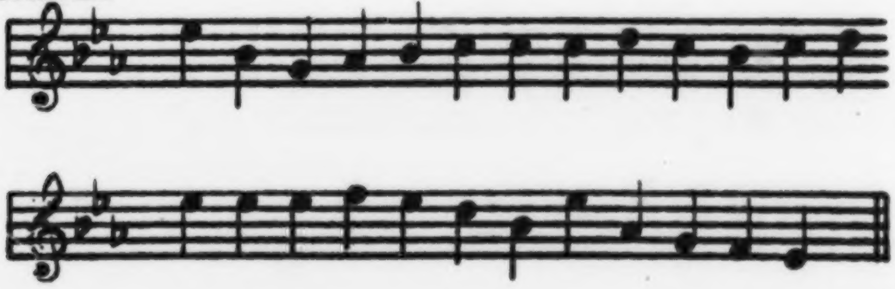


Check your answer.

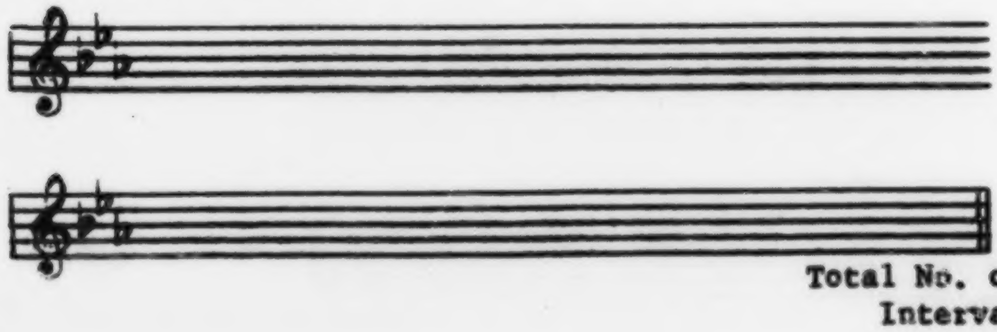
Total No. of Errors
Rhythm 2.

INTERVALS

2.



Check your answer.



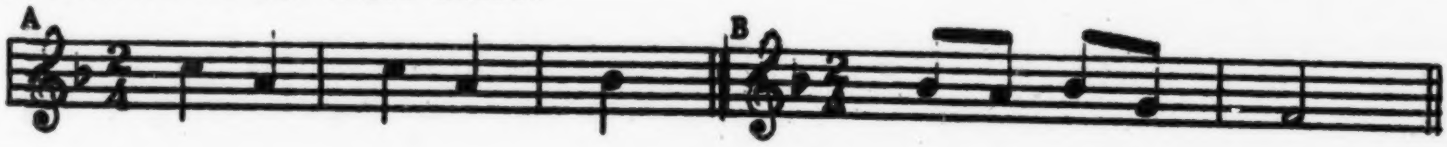
Total No. of Errors
Intervals 2.

NAME________________________________ TITLE MP 10

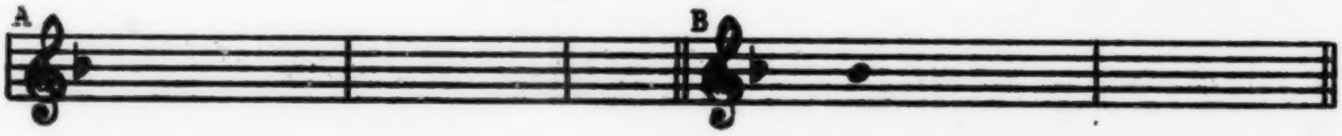
COURSE__________ INSTRUCTOR________________ DATE______________

In this exercise several series of melodic groups (combining rhythm and meter) will be played on the piano. Each group will be played twice. Before the first melodic group in each series, you will be given the tonic chord and the unit of beat. For the remaining melodic groups in a series, the first note will be given on the answer sheet. Clefs and key signatures will also appear on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1.

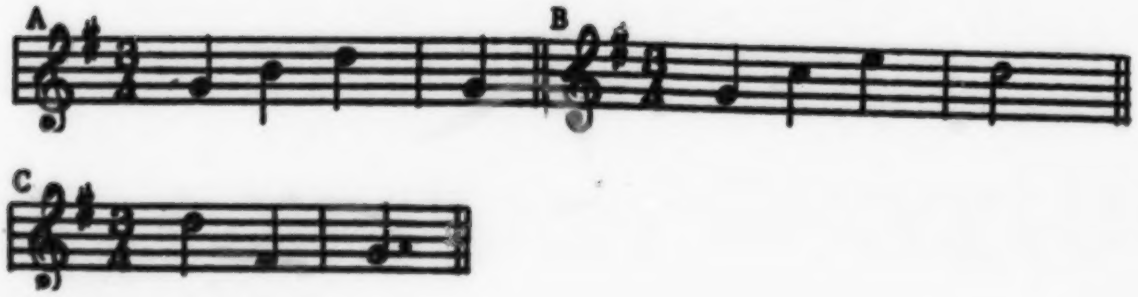


Check your answer.

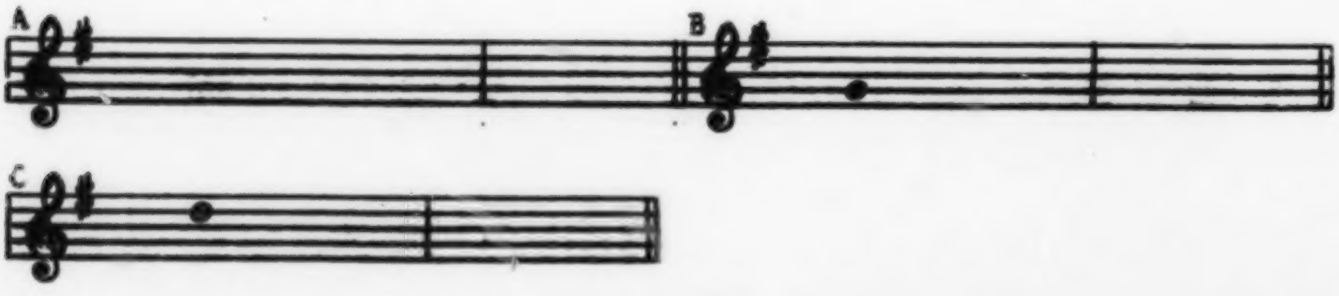


Total No. of Errors
Melody 1. ☐

2.



Check your answer.



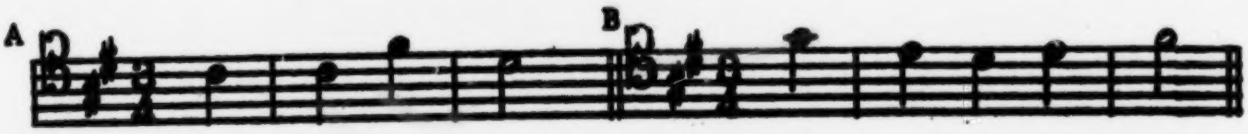
Total No. of Errors
Melody 2. ☐

NAME____ TITLE MP 20____________

COURSE__________ INSTRUCTOR______________________ DATE__________________

In this exercise several series of melodic groups (combining rhythm and meter) will be played on the piano. Each group will be played twice. Before the first melodic group in each series, you will be given the tonic chord and the unit of beat. For the remaining melodic groups in a series, the first note will be given on the answer sheet. Clefs and key signatures will also appear on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

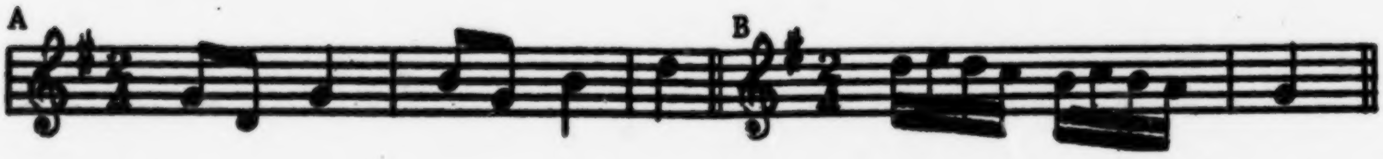
1.



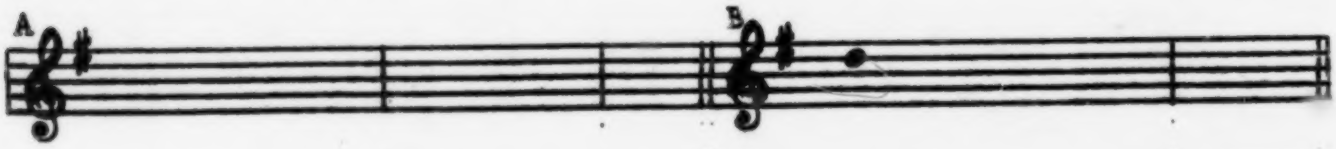
Check your answer.

Total No. of Errors
Melody 1. ☐

2.



Check your answer.



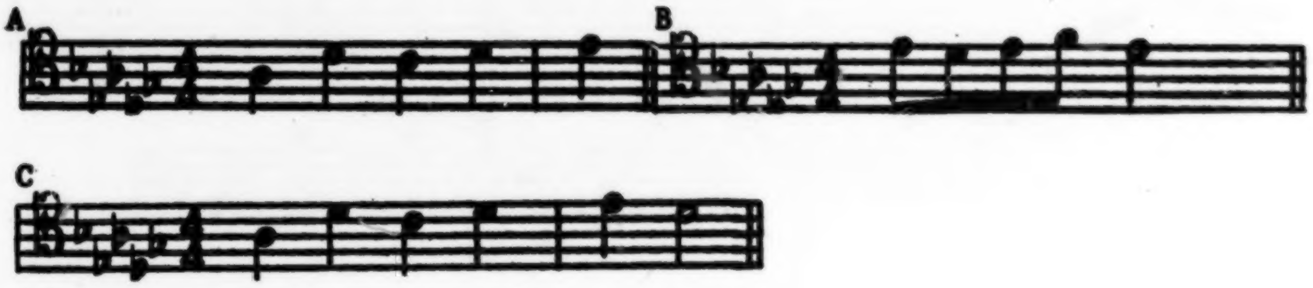
Total No. of Errors
Melody 2. ☐

NAME______________________________ TITLE MP 30

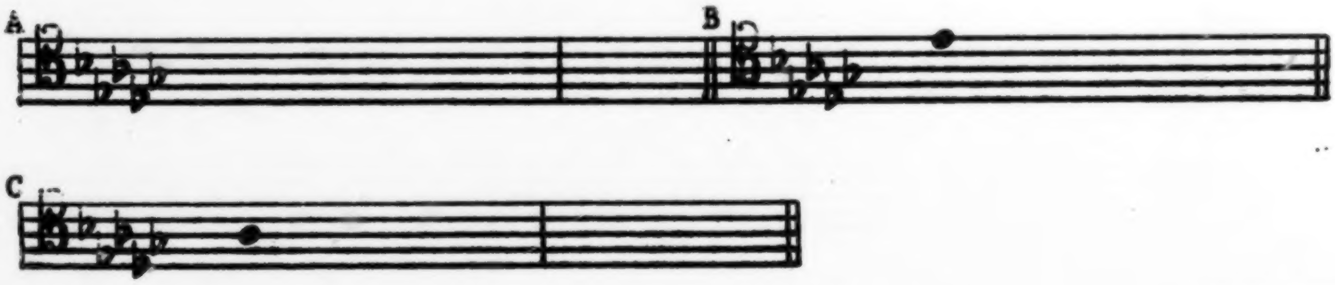
COURSE__________ INSTRUCTOR__________________ DATE______________

In this exercise several series of melodic groups (combining rhythm and meter) will be played on the piano. Each group will be played twice. Before the first melodic group in each series, you will be given the tonic chord and the unit of beat. For the remaining melodic groups in a series, the first note will be given on the answer sheet. Clefs and key signatures will also appear on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1.

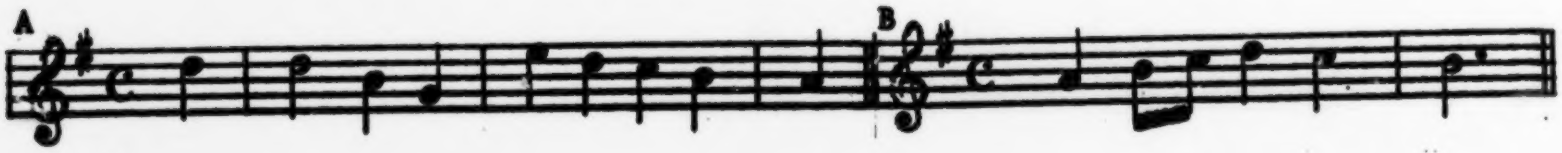


Check your answer.

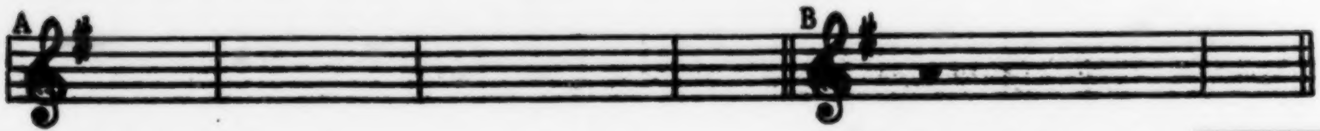


Total No. of Errors
Melody 1. ☐

2.



Check your answer.



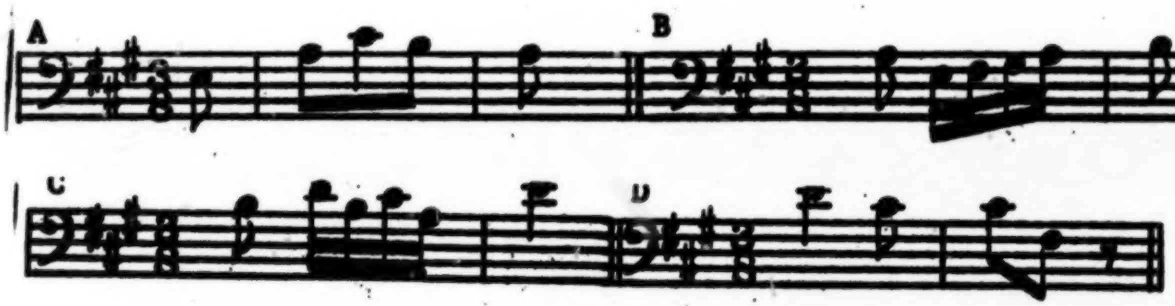
Total No. of Errors
Melody 2. ☐

NAME____ TITLE MP 40

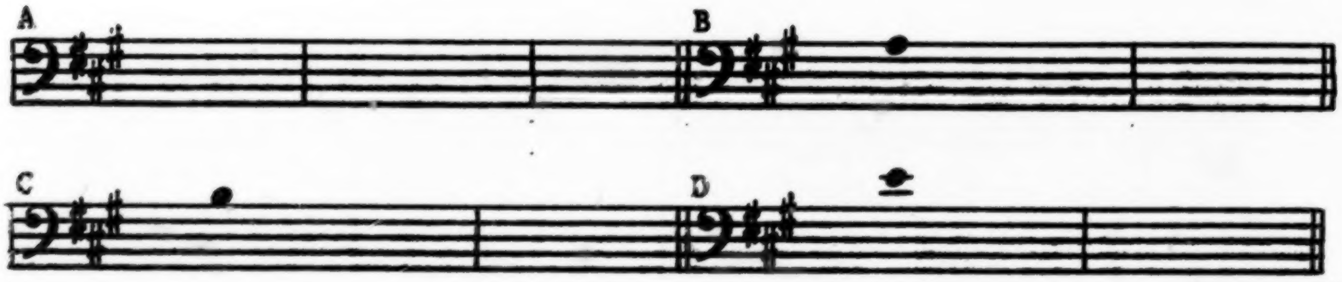
COURSE______________INSTRUCTOR____________________ DATE________________

In this exercise several series of melodic groups (combining rhythm and meter) will be played on the piano. Each group will be played twice. Before the first melodic group in each series, you will be given the tonic chord and the unit of beat. For the remaining melodic groups in a series, the first note will be given on the answer sheet. Clefs and key signatures will also appear on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1.

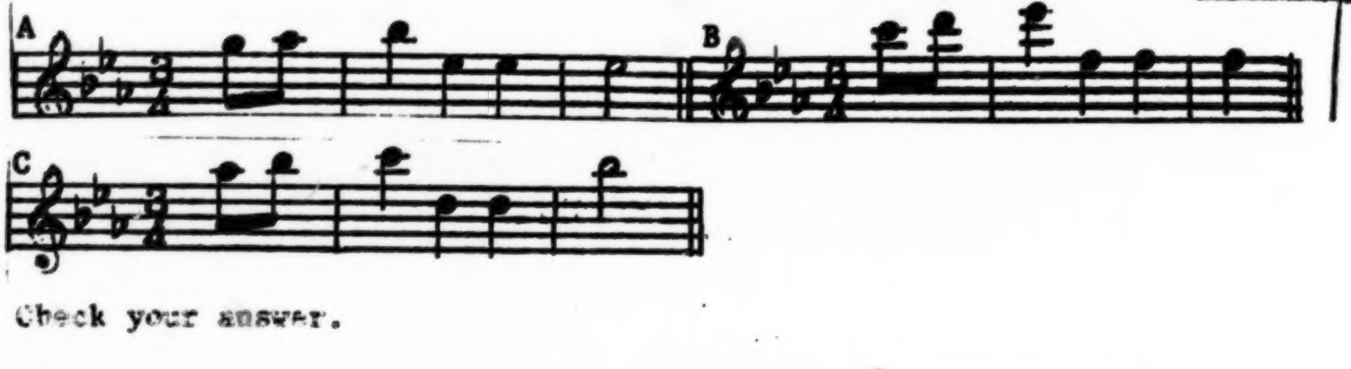


Check your answer.



Total No. of Errors
Melody 1.

2.



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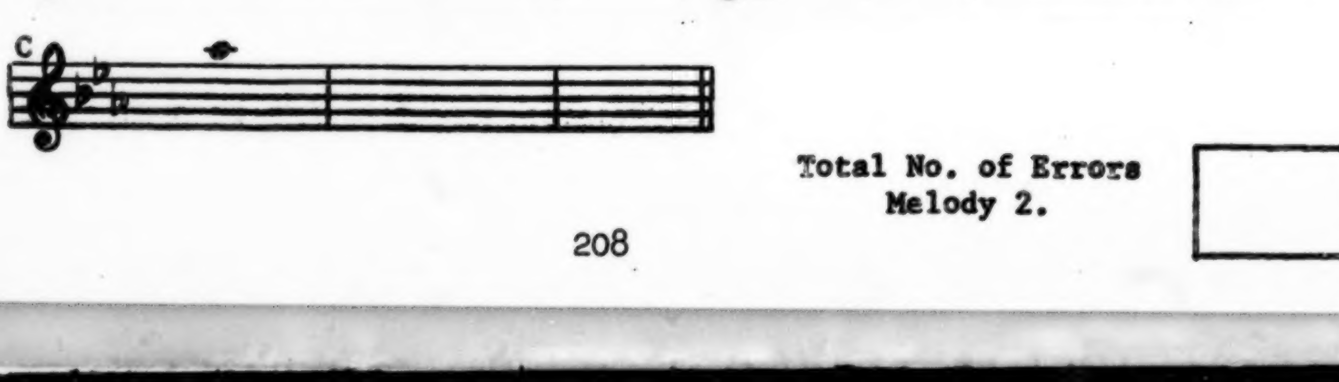


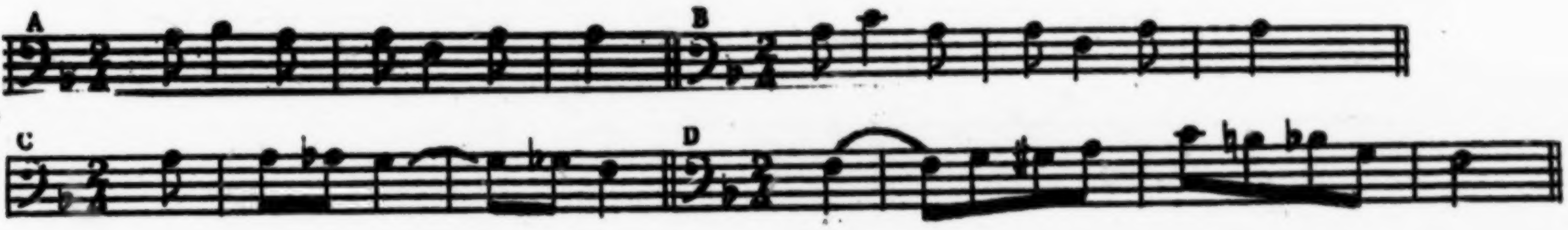
Total No. of Errors
Melody 2.

NAME________________________________ TITLE MP 50____________

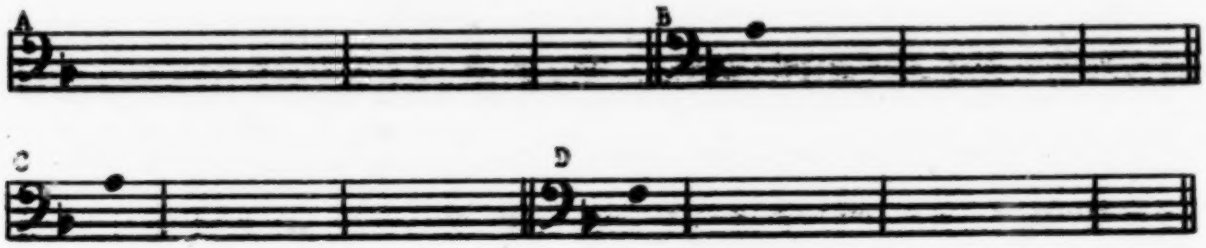
COURSE__________ INSTRUCTOR____________________ DATE________________

In this exercise several series of melodic groups (combining rhythm and meter) will be played on the piano. Each group will be played twice. Before the first melodic group in each series, you will be given the tonic chord and the unit of beat. For the remaining melodic groups in a series, the first note will be given on the answer sheet. Clefs and key signatures will also appear on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.

1.

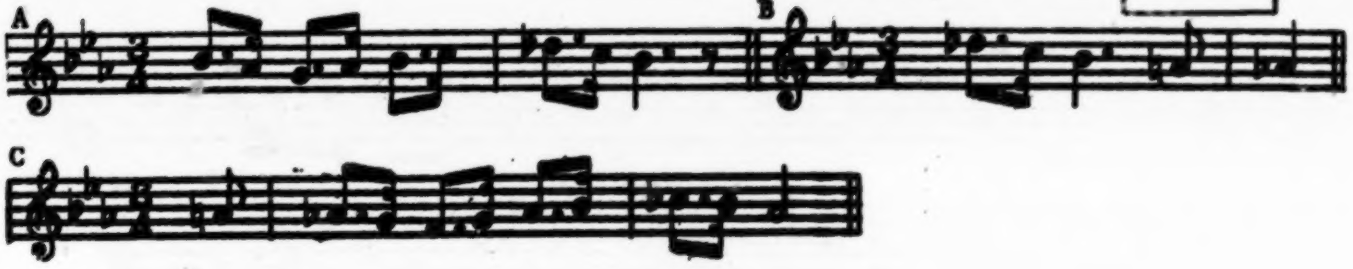


Check your answer.



Total No. of Errors
Melody 1. ☐

2.



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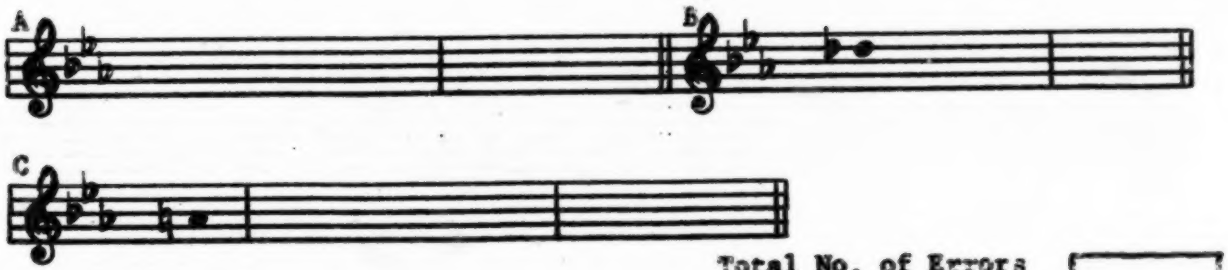
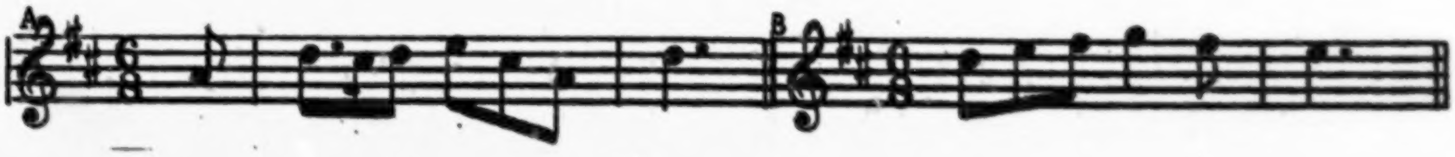


Total No. of Errors
Melody 2. ☐

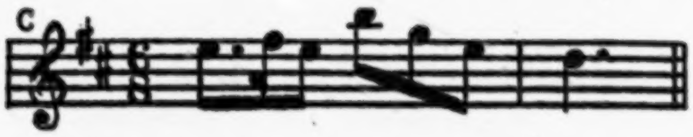
NAME______________________________ TITLE MP 60____________

COURSE__________ INSTRUCTOR________________ DATE____________

In this exercise several series of melodic groups (combining rhythm and meter) will be played on the piano. Each group will be played twice. Before the first melodic group in each series, you will be given the tonic chord and the unit of beat. For the remaining melodic groups in a series, the first note will be given on the answer sheet. Clefs and key signatures will also appear on this answer sheet. You will have to place the appropriate meter signature on the staff. If you wrote the melody correctly, make a check on the extra staff. If you made an error, write the correct notation on the extra staff.



1.



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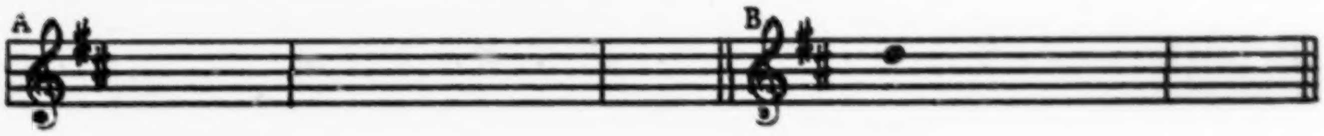
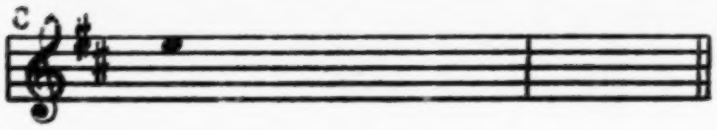
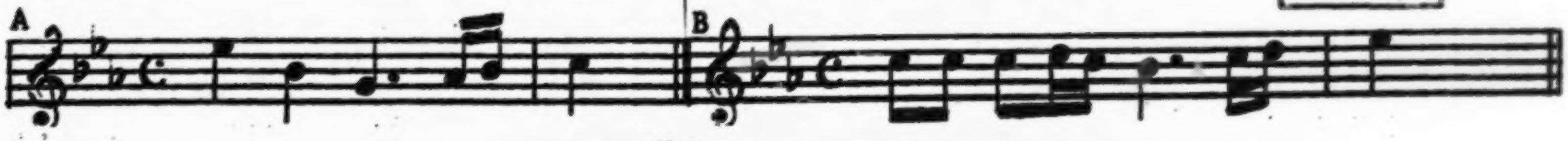
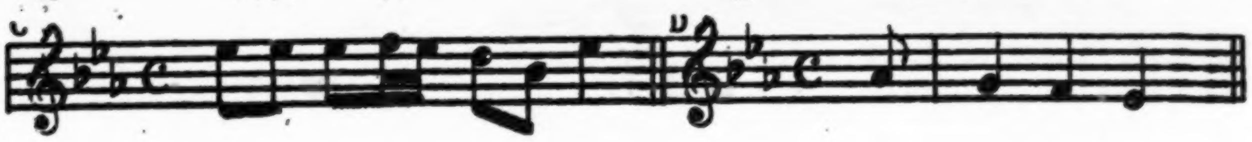


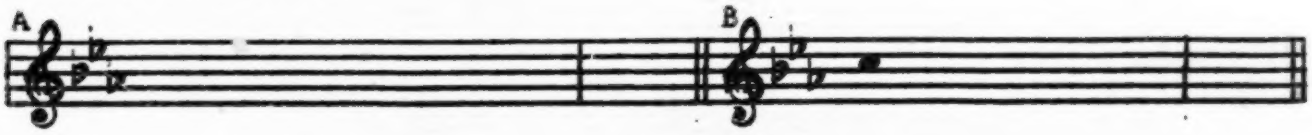


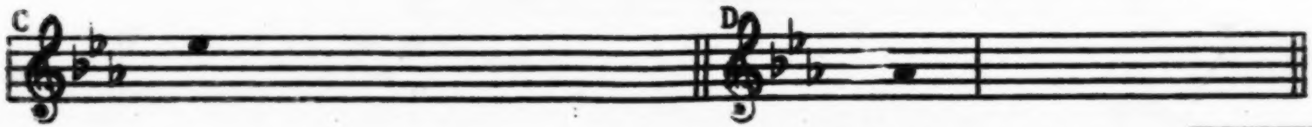
Total No. of Errors
Melody 1. ☐





Check your answer.





Total No. of Errors
Melody 2. ☐

APPENDIX D

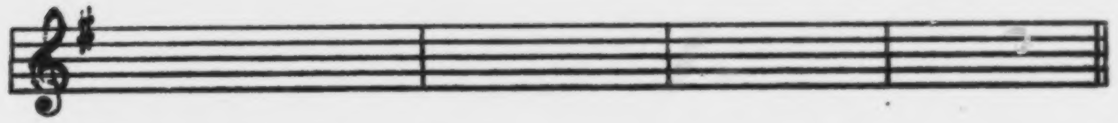
MELODY PRE AND POSTTEST

MELODIC TEST

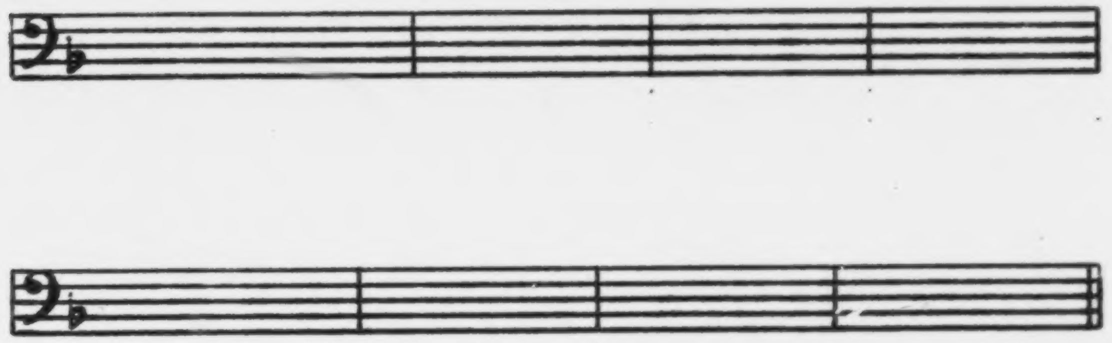
NAME______________________________ COURSE__________ INSTRUCTOR__________________

In this part of the test you will be asked to write melodies that will be played on the piano. These melodies will be played three times with enough time between each playing to write the melodies. You will first hear the tonic chord. The unit of beat will be given and the first beats of measures will be accented. The clef and key signature are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff.

1.



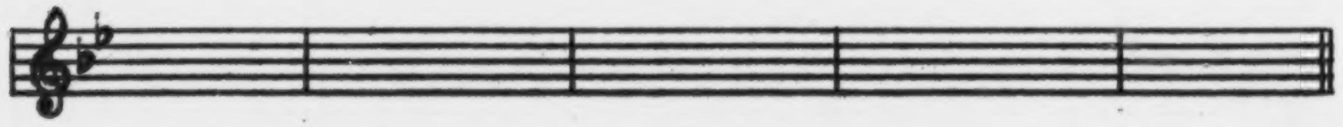
2.



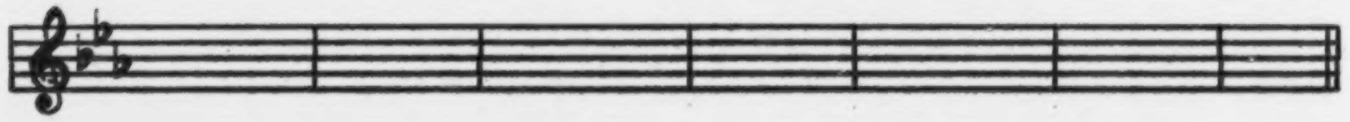
3.

NAME______________________________ COURSE________ INSTRUCTOR__________________

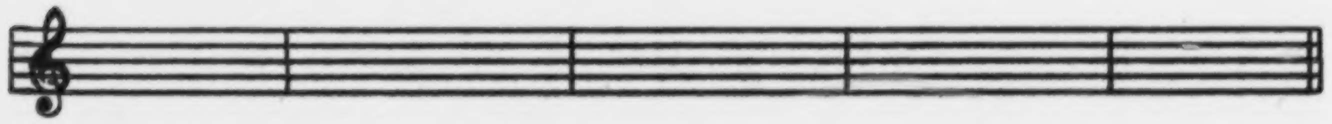
4.



5.



6.



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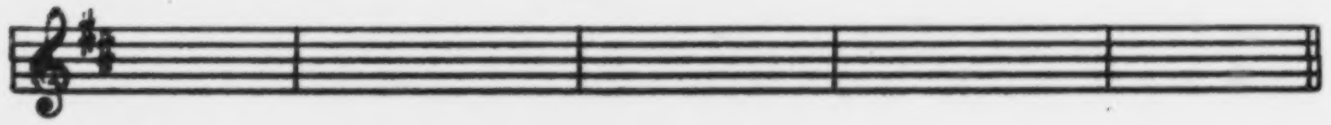

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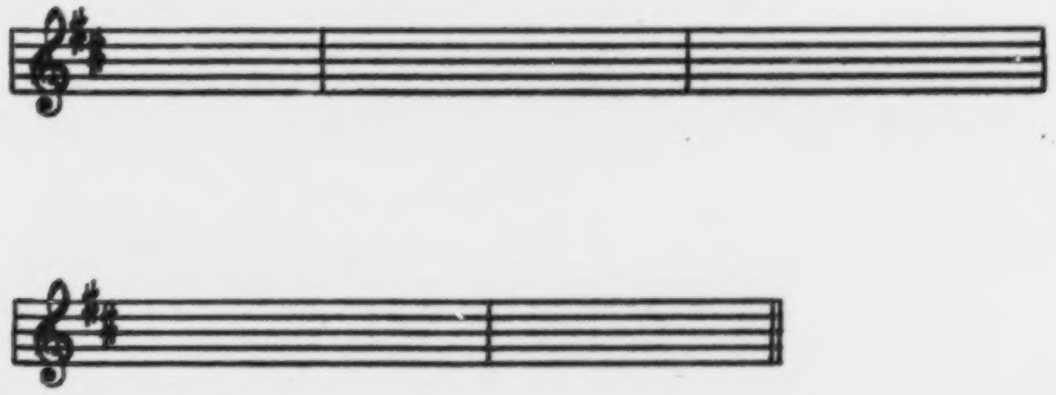
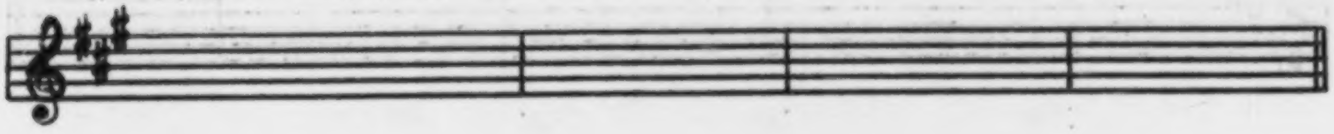


NAME______________________________ **COURSE**________ **INSTRUCTOR**______________________

9.



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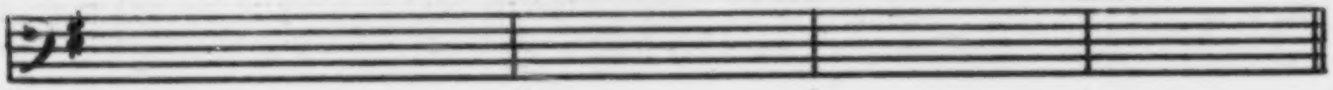
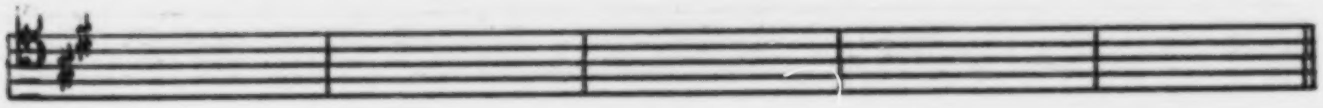
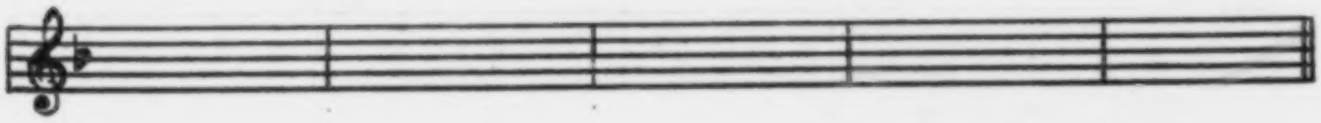


11.



12.

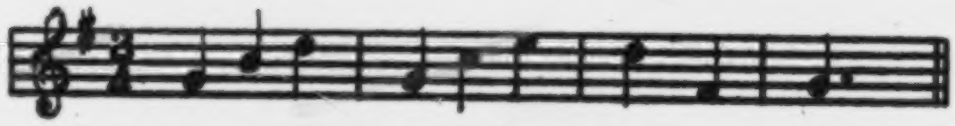


MELODIC TEST

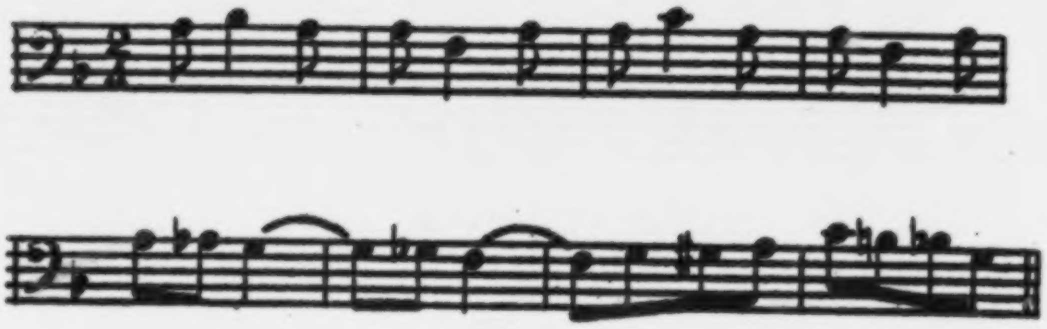
NAME________________________________ COURSE____________ INSTRUCTOR_____________________

In this part of the test you will be asked to write melodies that will be played on the piano. These melodies will be played three times with enough time between each playing to write the melodies. You will first hear the tonic chord. The unit of beat will be given and the first beats of measures will be accented. The clef and key signature are indicated on this answer sheet. You will have to place the appropriate meter signature on the staff.

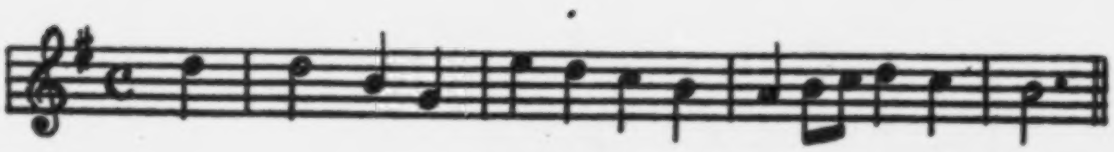
1.



2.

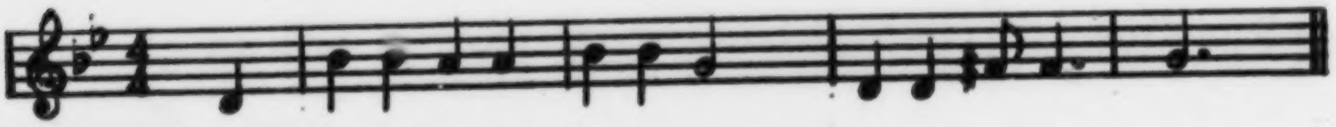


3.



NAME________________________________ COURSE__________ INSTRUCTOR____________________

4.



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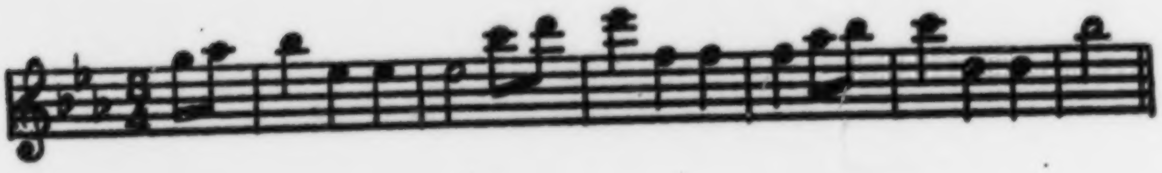

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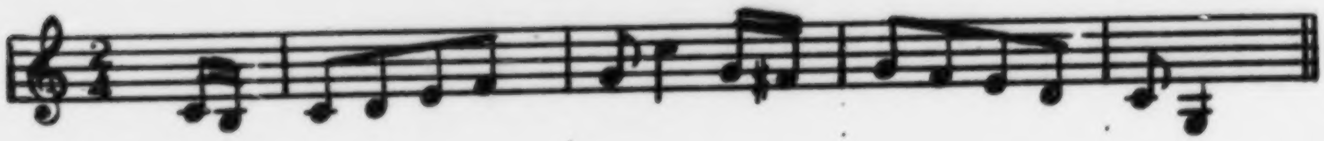

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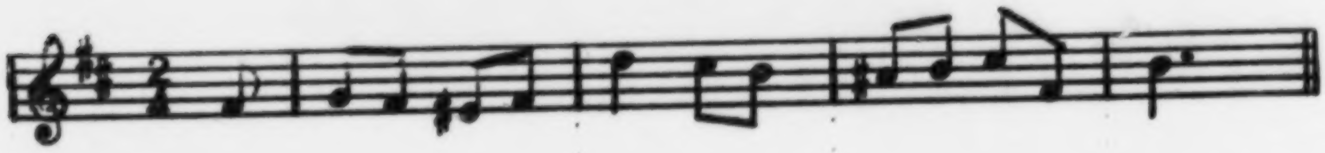

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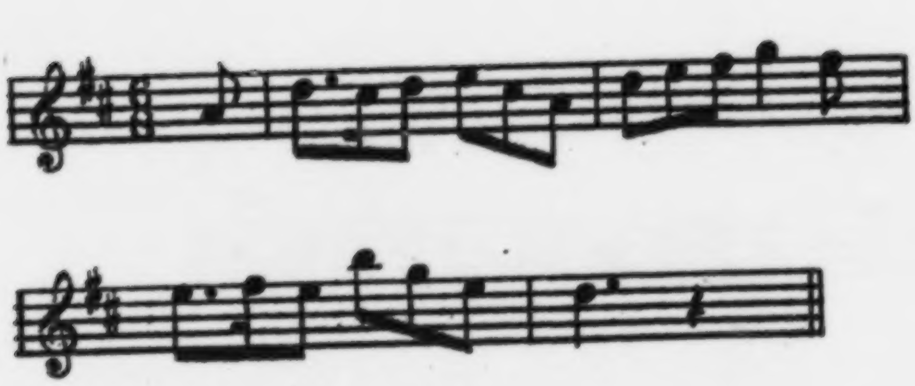
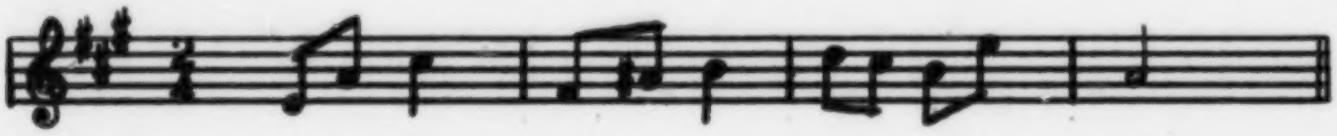


NAME________________ COURSE________ INSTRUCTOR________________

9.



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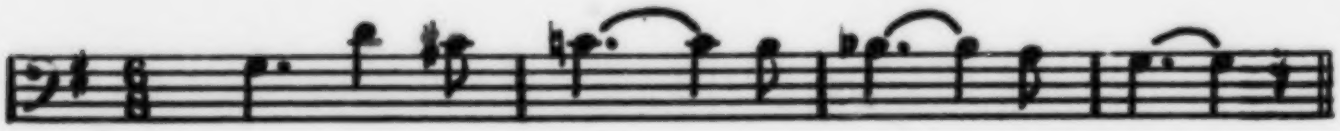

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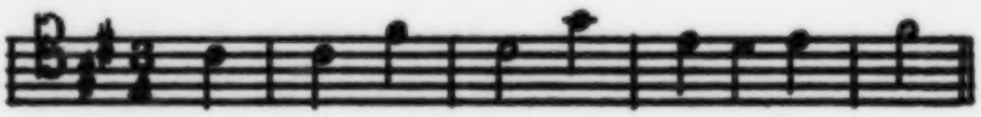

12.